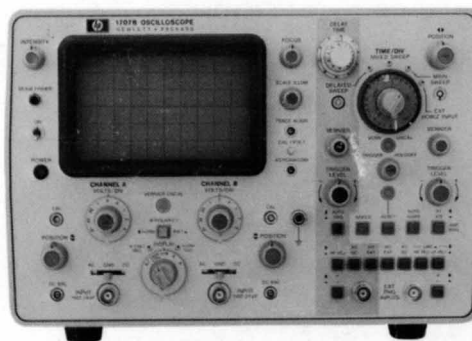


OPERATING AND SERVICE MANUAL

OSCILLOSCOPE

1707B



HEWLETT  PACKARD



OPERATING AND SERVICE MANUAL

MODEL 1707B OSCILLOSCOPE

SERIALS PREFIXED: 1410A

Refer to Section VII for instruments with the following standard options: **002, 007, 011, 012, 015, 602, 607, 611** and **631**.

HEWLETT-PACKARD COMPANY/COLORADO SPRINGS DIVISION
1900 GARDEN OF THE GODS ROAD, COLORADO SPRINGS, COLORADO, U.S.A.

Manual Part Number 01707-90916
Microfiche Number 01707-90816

PRINTED: APRIL 1974

SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.

GROUND THE INSTRUMENT.

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument is equipped with a three-conductor ac power cable. The power cable must either be plugged into an approved three-contact electrical outlet or used with a three-contact to two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of the power cable meet International Electrotechnical Commission (IEC) safety standards.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS.

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power and discharge circuits before touching them.

DO NOT SERVICE OR ADJUST ALONE.

Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

USE CAUTION WHEN EXPOSING OR HANDLING THE CRT.

Breakage of the cathode-ray tube (CRT) causes a high-velocity scattering of glass fragments (implosion). To prevent CRT implosion, avoid rough handling or jarring of the instrument. Handling of the CRT shall be done only by qualified maintenance personnel using approved safety mask and gloves.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT.

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to a Hewlett-Packard Sales and Service Office for service and repair to ensure that safety features are maintained.

DANGEROUS PROCEDURE WARNINGS.

Warnings, such as the example below, precede potentially dangerous procedures throughout this manual. Instructions contained in the warnings must be followed.

WARNING

*Dangerous voltages, capable of causing death, are present in this instrument.
Use extreme caution when handling, testing, and adjusting.*

TABLE OF CONTENTS

Section	Page	Section	Page
I GENERAL INFORMATION	1-1	3-48. Sweep Mode	3-5
1-1. Introduction	1-1	3-51. Trigger Selection	3-5
1-4. Description	1-1	3-54. Magnetic Interference	3-5
1-5. Introduction	1-1	3-56. Battery Recharge Operation	3-5
1-7. Vertical Circuits	1-1	3-58. Preoperational Adjustments	3-5
1-11. Horizontal Circuits	1-1	3-59. Initial Turn-on	3-5
1-17. Cathode-ray Tube	1-5	3-61. Focus and Astigmatism Adjust ..	3-6
1-20. Warranty	1-5	3-63. Operating Procedures	3-6
1-22. Accessories Furnished	1-5	3-65. Operators Performance Check	3-6
1-24. Accessories Available	1-5	3-67. Operating Information	3-7
1-26. Instrument and Manual		3-69. Auto Versus Norm	3-7
Identification	1-5	3-71. Auto Versus Trig	3-7
1-30. Inquiries	1-5	3-73. AC Versus DC	3-7
		3-75. Mixed Sweep	3-7
		3-77. Delayed Sweep	3-7
		3-80. Line Sync	3-7
II INSTALLATION	2-1	IV PRINCIPLES OF OPERATION	4-1
2-1. Introduction	2-1	4-1. Introduction	4-1
2-3. Initial Inspection	2-1	4-3. Block Diagram Discussion	4-1
2-6. Preparation for Use	2-1	4-6. Input Attenuator	4-1
2-7. Power Requirements	2-1	4-8. Vertical Preamplifier	4-1
2-11. Three-conductor AC Power		4-10. Delay Line	4-1
Cable	2-1	4-12. Vertical Output Amplifier	4-1
2-13. DC Plug	2-2	4-14. Trigger Circuits	4-1
2-15. Battery Installation	2-2	4-16. Main Integrator	4-1
2-17. Claims	2-2	4-21. Holdoff and Comparator	4-2
2-19. Repacking for Shipment	2-2	4-24. Delayed Integrator	4-2
		4-27. Timing Sequence	4-3
III OPERATION	3-1	4-31. Horizontal Mode Assembly	4-3
3-1. Introduction	3-1	4-35. Low Voltage Power Supply	4-3
3-3. Controls and Connectors	3-1	4-41. High Voltage Power Supply	4-3
3-5. Beam Finder	3-1	4-44. Gate Amplifier	4-4
3-7. Scale Illumination	3-1	4-46. Detailed Circuit Theory	4-4
3-9. Trace Align	3-1	4-48. Input Attenuators	4-4
3-11. Calibrator	3-1	4-53. Vertical Preamplifier	4-4
3-13. Focus and Astigmatism	3-1	4-79. Delay Line	4-6
3-15. Coupling	3-1	4-81. Vertical Output Amplifier	4-6
3-17. Display	3-4	4-86. Trigger Circuits	4-6
3-24. Trig	3-4	4-104. Main Integrator	4-8
3-26. B Polarity	3-4	4-119. Holdoff and Comparator	4-10
3-28. Sweep Display	3-4	4-124. Delayed Integrator	4-10
3-30. Ext Horiz Input	3-4	4-130. Horizontal Mode	4-11
3-32. Main Sweep	3-4	4-148. Gate Assembly	4-13
3-34. Mixed Sweep	3-4	4-156. Calibrator	4-14
3-36. Delayed Sweep	3-4	4-158. Horizontal Preamplifier and	
3-38. Time/Div.	3-4	Output Assemblies	4-14
3-40. Vernier	3-4	4-162. Indicator Drivers	4-14
3-42. Trigger Level	3-4	4-165. Low Voltage Power	
3-44. Trigger Holdoff	3-4	Supply	4-14
3-46. Slope	3-4	4-174. High Voltage Power	
		Supply	4-16

TABLE OF CONTENTS (Cont'd)

Section	Page	Section	Page
V PERFORMANCE CHECK AND ADJUSTMENTS	5-1	5-190. Delayed Sweep Time Adjustment	5-23
5-1. Introduction	5-1	5-195. X10 Gain Adjustment	5-24
5-3. Test Equipment	5-1	5-200. Mag Centering Adjustment	5-24
5-5. Performance Check	5-1	5-205. Calibrator Adjustment	5-25
5-8. Front-panel Adjustments	5-1	5-210. Ext Horiz Input Compensation .	5-25
5-10. Front-panel Settings	5-1	5-215. Ext Horiz Gain Adjust	5-26
5-12. Performance Tests	5-1	5-220. Low-frequency Pulse Response Adj.	5-26
5-13. Deflection Factor	5-1	5-225. Input Capacitance and Attenuator Compensation Adjustment ..	5-26
5-18. Rise time	5-2	5-230. High-frequency Pulse Response Adj	5-27
5-23. Bandwidth	5-3		
5-28. A+B Mode	5-3	VI REPLACEABLE PARTS	6-1
5-33. Alt Mode	5-4	6-1. Introduction	6-1
5-38. Chop Mode	5-4	6-3. Ordering Information	6-1
5-43. Single Sweep	5-5		
5-48. Auto Trig Recovery Time	5-5	VII MANUAL CHANGES AND OPTIONS....	7-1
5-53. Z Axis Sensitivity	5-6	7-1. Introduction	7-1
5-58. Beam Finder	5-6	7-3. Manual Changes	7-1
5-63. Coupling Switch	5-6	7-5. Special Options	7-1
5-68. Input Resistance	5-7	7-9. Standard Options	7-1
5-73. Common Rejection Ratio (CMRR)	5-8		
5-78. Main Sweep Time	5-8	VIII SCHEMATICS AND TROUBLE-SHOOTING	8-1
5-83. Delayed Sweep Time	5-9	8-1. Introduction	8-1
5-88. Delay Time Accuracy	5-10	8-3. Schematics	8-1
5-93. Delay Time Linearity	5-11	8-8. Reference Designations	8-1
5-98. Delay Jitter	5-12	8-12. Component Locations	8-1
5-103. Main Triggering	5-13	8-15. Preventive Maintenance	8-1
5-108. Delayed Triggering	5-14	8-17. Mechanical Inspection	8-1
5-113. Main Trigger Level Range and Polarity	5-15	8-22. Switch Maintenance	8-2
5-118. Delayed Trigger Level Range and Polarity	5-16	8-27. Repair and Replacement	8-2
5-123. Ext Horizontal Bandwidth	5-16	8-29. CRT Removal and Replacement	8-2
5-128. Ext Horizontal Deflection Factor	5-17	8-31. Vertical Amplifier Module Removal and Replacement ..	8-3
5-133. Calibrator	5-17	8-33. Delay Line Removal and Replacement	8-3
5-138. Adjustments	5-19	8-35. Attenuator Removal and Replacement	8-3
5-142. Adjust Procedures	5-19	8-37. Removal and Replacement of Assemblies in Horizontal Amplifier Module	8-5
5-143. Low Voltage Power Supply Adjustment	5-19	8-42. Power Supply Module Removal and Replacement ..	8-5
5-148. High Voltage Power Supply Adjustment	5-19	8-44. Power Supply Module Disassembly and Reassembly ..	8-5
5-153. Intensity Limit Adjustment	5-20	8-46. Semiconductor Removal and Replacement	8-6
5-157. Y-Axis Alignment	5-20	8-48. Attenuator Servicing	8-6
5-162. Gate Amplifier Response Adjustment	5-20		
5-167. Trigger Amplifier Balance and DC Adjustment	5-21		
5-172. Trigger Sensitivity	5-21		
5-177. Position Centering Adjustment .	5-22		
5-181. Sweep Length Adjustment	5-22		
5-185. Main Sweep Timing Adjustment	5-23		

TABLE OF CONTENTS (Cont'd)

Section	Page	Section	Page
8-50. Circuit Boards	8-6	8-62. Soldering Tool, Solder, and	
8-52. Board Connections	8-6	Aids	8-7
8-54. Servicing Etched Circuit		8-64. Heat Sink Removal	8-8
Boards	8-6	8-66. Troubleshooting	8-8
8-56. Integrated Circuit Replace-		8-69. DC Voltages	8-8
ment	8-6	8-71. Waveforms	8-8
8-60. Service Kit	8-7	8-73. Test Points	8-8
		8-75. Circuit Checking	8-9

LIST OF ILLUSTRATIONS

Figure	Title	Page	Figure	Title	Page
1-1. Model 1707B Oscilloscope		1-0	5-12. Main Triggering Test Setup		5-13
1-2. Instrument Serial Number		1-5	5-13. Delayed Triggering Test Setup		5-14
1-3. Service Kit for HP 1700-series			5-14. Main Trigger Level Range and Polarity		
Oscilloscopes		1-6	Test Setup		5-15
2-1. Rear Panel Power Module		2-1	5-15. Delayed Trigger Level Range and		
2-2. Battery Pack Installation		2-2	Polarity Test Setup		5-16
3-1. Controls and Connectors		3-2	5-16. EXT Horizontal Bandwidth		
3-2. Sweep Combinations		3-5	Test Setup		5-17
3-3. DC BAL Adjust		3-8	5-17. EXT Horizontal Deflection Factor		
3-4. CAL Adjust		3-9	Test Setup		5-17
3-5. Algebraic Addition and Differential			5-18. Calibrator Test Setup		5-18
Operation		3-10	5-19. Adjustment		5-29
3-6. Delayed Sweep		3-11	6-1. Knob Locator		6-2
3-7. Mixed Sweep		3-12	6-2. Mechanical Parts Locator		6-3
4-1. Timing Sequence		4-2	8-1. Vertical Module Mechanical Parts		
4-2. Step-by-step operation of the			Removal		8-4
Gate Schmitt Trigger		4-7	8-2. Attenuator Removal		8-4
4-3. Step-by-step operation of the Set-			8-3. Semiconductor Terminal Identification ..		8-7
reset Multivibrator		4-9	8-4. Component Identification, Interior Front		
4-4. Blanking Sequence		4-12	and rear Panel		8-23
5-1. Deflection Factor Test Setup		5-2	8-5. Component and Assembly Locations ..		8-23
5-2. Rise time Test Setup		5-3	8-6. Vertical Module A5 Component		
5-3. Bandwidth Test Setup		5-3	Identification		8-24
5-4. A+B Mode Test Setup		5-4	8-7. Horizontal Module A6 Component		
5-5. Input Resistance Test Setup		5-7	Identification		8-24
5-6. CMRR Test Setup		5-8	8-8. Main Block Diagram		8-25
5-7. Main Sweep Time Test Setup		5-8	8-9. Power Supply Block Diagram		8-27
5-8. Delayed Sweep Time Test Setup		5-10	8-10. Attenuator Component Identification ..		8-28
5-9. Delay Time Accuracy Test Setup		5-10	8-11. Attenuator Schematic		8-29
5-10. Delay Time Linearity Test Setup		5-11	8-12. Vertical Preamplifier Assembly A5A4		
5-11. Delay Jitter Test Setup		5-12	Component Identification		8-30
			8-13. Vertical Preamplifier Assembly		
			A5A4		8-31
			8-14. Vertical Preamplifier Assembly		
			A5A4		8-33
			8-15. Vertical Preamplifier Assembly A5A4		
			Component Identification		8-34

LIST OF ILLUSTRATIONS (Cont'd)

Figure	Title	Page	Figure	Title	Page
8-16.	Vertical Preamplifier A5A4 and Vertical Output Amplifier A5A5	8-35	8-32.	Horizontal Mode Assembly A6A8 Component Identification	8-52
8-17.	Vertical Preamplifier A5A4	8-37	8-33.	EXT Horizontal Amplifier Assembly A8, Component Identification	8-52
8-18.	Trigger Assembly A6A2 Component Identification	8-38	8-34.	Horizontal Mode Assembly A6A8	8-53
8-19.	Trigger Assembly A6A2	8-39	8-35.	Horizontal Preamplifier Assembly A6A9 Component Identification	8-54
8-20.	Trigger Assembly A6A2	8-41	8-36.	Horizontal Output Amplifier Assembly A6A10 Component Identification	8-54
8-21.	Horizontal Mother Board A6A1 Component Identification	8-42	8-37.	Horizontal Preamplifier and Output Assemblies A6A9 and A6A10	8-55
8-22.	Main Integrator A6A3 Component Identification	8-42	8-38.	Gate Assembly A4 Component Identification	8-56
8-23.	Main Integrator A6A3	8-43	8-39.	Gate Assembly A4	8-57
8-24.	Main Sweep Time Assembly A6A5 Component Identification	8-44	8-40.	High Voltage Oscillator A3A4 Component Identification	8-58
8-25.	Main Sweep Time Assembly A6A5	8-45	8-41.	High Voltage Oscillator A3A4	8-59
8-26.	Delayed Integrator A6A4 Component Identification	8-46	8-42.	Line Rectifier A2 Component Identification	8-60
8-27.	Delayed Integrator A6A4	8-47	8-43.	Low Voltage Mother Board A3A1 Component Identification	8-60
8-28.	Delayed Sweep Time Assembly A6A6 Component Identification	8-48	8-44.	Power Input and Line Filters	8-61
8-29.	Delayed Sweep Time Assembly A6A6	8-49	8-45.	Low Voltage Converter Assembly A3A2 Component Identification	8-62
8-30.	Holdoff and Comparator A6A7 Component Identification	8-50	8-46.	Low Voltage Converter Assembly A3A2	8-63
8-31.	Holdoff and Comparator A6A7	8-51	8-47.	Line Rectifier and Filter A3A3 Component Identification	8-64
			8-48.	Line Rectifier and Filter A3A3	8-65
			8-49.	Horizontal Mother Board A6A1	8-67
			8-50.	Horizontal Preamplifier A6A9 Voltage Distribution	8-68

LIST OF TABLES

Table	Title	Page	Table	Title	Page
1-1.	Specifications	1-2	6-2.	Replaceable Parts	6-5
1-2.	Model 1707B Accessories Available ..	1-5/1-6	6-3.	List of Manufacturers' Code	6-25
5-1.	Recommended Test Equipment	5-0	7-1.	Model 1707B Standard Options	7-2
5-2.	Deflection Factor Accuracy	5-2	8-1.	Etched Circuit Soldering Equipment	8-8
5-3.	Main Sweep Performance Check	5-9	8-2.	Model 1707B Assembly Locations	8-9
5-4.	Delayed Sweep Performance Check	5-11	8-3.	Schematic Notes	8-10
	Performance Check Record	5-18a	8-4.	Troubleshooting Low Voltage Power Supply	8-11
5-5.	Power Supply Voltage Limits	5-19	8-5.	Troubleshooting High Voltage Power Supply, CRT, Gate	8-13
5-6.	Main Sweep Time Adjustments	5-23	8-6.	Troubleshooting Vertical Deflection	8-16
5-7.	Delayed Sweep Time Adjustments	5-24			
5-8.	Square-wave Adjustment	5-27			
5-9.	Capacitance Adjustment	5-27			
6-1.	Abbreviations for Replaceable Parts List	6-1			

LIST OF TABLES (Cont'd)

Table	Title	Page	Table	Title	Page
8-7.	Troubleshooting Horizontal	8-19	8-18.	Schematic 12 Measurement Con- ditions and Waveforms.....	8-46
8-8.	Troubleshooting Time Base	8-20	8-19.	Schematic 13 Measurement Con- ditions	8-48
8-9.	Block Diagram Measurement Conditions	8-24	8-20.	Schematic 14 Measurement Con- ditions and Waveforms.....	8-50
8-10.	Schematic 4 Measurement Con- ditions and Waveforms.....	8-31	8-21.	Schematic 15 Measurement Con- ditions and Waveforms.....	8-52
8-11.	Schematic 5 Measurement Con- ditions and Waveforms.....	8-32	8-22.	Schematic 16 Measurement Con- ditions and Waveforms.....	8-54
8-12.	Schematic 6 Measurement Con- ditions and Waveforms.....	8-34	8-23.	Schematic 17 Measurement Con- ditions and Waveforms.....	8-56
8-13.	Schematic 7 Measurement Con- ditions and Waveforms.....	8-36	8-24.	Schematic 18 Measurement Con- ditions and Waveforms.....	8-58
8-14.	Schematic 8 Measurement Con- ditions and Waveforms.....	8-38	8-25.	Schematic 19 Measurement Con- ditions	8-60
8-15.	Schematic 9 Measurement Con- ditions and Waveforms.....	8-40	8-26.	Schematic 20 Measurement Con- ditions and Waveforms.....	8-62
8-16.	Schematic 10 Measurement Con- ditions and Waveforms.....	8-43			
8-17.	Schematic 11 Measurement Con- ditions	8-44			



1707-P-001

Figure 1-1. Model 1707B Oscilloscope

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual provides operating and service information for the Hewlett-Packard Model 1707B Oscilloscope (figure 1-1). This manual is divided into eight sections, each covering a specific topic or aspect of the instrument. All schematics are located at the rear of the manual. Also located at the rear of the manual are instruction cards located in an envelope attached to the inside back cover. These cards explain the function of each instrument control. The card is designed to fit the inside lid of the front panel storage cover.

1-3. This section contains a description of Model 1707B. Instrument specifications are listed in table 1-1. Table 7-2 lists the options available for Model 1707B.

1-4. DESCRIPTION.

1-5. INTRODUCTION.

1-6. The Model 1707B is a general-purpose, wide-band oscilloscope designed for bench or field service. The Model 1707B operates from an ac line, dc line or optional battery pack. The optional rechargeable nickel cadmium batteries provide up to 4½ hours of operation and require a recharge time of approximately 14 hours. A carrying handle provides ease of transportation and is adjustable, allowing the Model 1707B to be placed at an angle for viewing the CRT.

1-7. VERTICAL CIRCUITS.

1-8. Vertical bandwidth is 75 MHz with a rise time less than 4.7 ns. Maximum vertical deflection factor is 10 mV/div. The Model 1707B contains two identical vertical amplifiers for single or dual channel operation. Each channel offers a choice of ac or dc coupling. Common mode rejection is at least 40 dB at 10 mV/div, and 20 dB for the rest of the deflection ranges.

1-9. Nine calibrated switch settings provide a deflection factor range from 10 mV/div to 5 V/div in a 1, 2, 5 sequence. The vertical verniers permit continuous adjustment between calibrated steps and extend the least sensitive deflection factor (5 V/div) to at least 12.5 V/div.

1-10. With the dual-trace feature, displays can be obtained on either channel A or B, channels A and B together, channels A + B, and channels A — B. Simultaneous display of two signals is possible in either chop or alternate mode of operation. During chop operation, channels are switched at an approximate rate of 400-kHz during each sweep. In the alternate mode of operation, the signal applied to each channel is displayed on alternate sweeps. Triggering is selectable from either A ONLY TRIG or NORM TRIG position. In the NORM TRIG position, the instrument triggers on the displayed signal. In the A ONLY TRIG position, the instrument triggers on the signal applied to channel A.

1-11. HORIZONTAL CIRCUITS.

1-12. The horizontal circuits provide four types of sweep displays. The displays are main sweep, mixed sweep, delayed sweep and external horizontal input.

1-13. Operation of the delayed sweep while in the main sweep mode provides trace intensification. The amount of intensification width depends on the delayed front panel settings. In the delayed mode, the intensified portion is displayed across the entire CRT.

1-14. Sweep speed settings from 0.1 usec/div to 2 sec/div (main sweep) and 0.1 usec/div to 0.2 sec/div (delayed sweep) are available in a 1, 2, 5 sequence. Vernier controls allow continuous adjustment between steps and extend the slowest sweep to 5 sec/div (main sweep) and 0.5 sec/div (delayed sweep). Using the magnifier function, the fastest sweep speed can be expanded to 10 ns/div. The mixed sweep function provides for simultaneous display of an input waveform and an expanded portion of the waveform. The delayed circuits are calibrated, permitting accurate time difference measurements to be made.

1-15. The main and delayed trigger circuits have provisions for either internal or external operation. Choice of trigger coupling is provided; ac/dc, high frequency reject, and low frequency reject. The delayed trigger circuit does not have low frequency reject trigger coupling.

1-16. An external horizontal input allows the use of an external signal to drive the horizontal deflection plates of the CRT.

VERTICAL AMPLIFIERS

MODES OF OPERATION: channel A; channel B; channels A and B displayed alternately on successive sweeps (alt); channels A and B displayed by switching between channels at approximately 400-kHz rate with blanking during switching (chop); channel A + channel B (algebraic addition).

EACH CHANNEL (2)

Bandwidth: (Direct or with Model 10006B probe, 3-dB down from 50-kHz, 6-div reference signal from terminated 50-ohm source.)

DC-COUPLED: dc to 75 MHz.

AC-COUPLED: lower limit is approximately 10 Hz.

Risetime: <4.7 ns direct or with Model 10006B probe, 10% to 90% points with 6 div input step from terminated 50-ohm source.

DEFLECTION FACTOR

Ranges: from 10 mV/div to 5 V/div (9 ranges) in 1, 2, 5 sequence; $\pm 3\%$ accuracy with vernier in calibrated position.

Vernier: continuously variable between all ranges, extends maximum deflection factor to at least 12.5 V/div.

Polarity: NORM or INVT selectable on channel B.

Signal Delay: input signals are delayed sufficiently to view leading edge of input signals without advanced external trigger.

Input RC: 1 megohm $\pm 2\%$, shunted by approximately 24 pF.

Input Coupling: AC, DC or GND selectable. GND position disconnects signal input and grounds amplifier input.

MAXIMUM INPUT

AC-coupled: $\pm 600\text{V}$ (dc + pk ac); rms ac <350V, 5 V/div to 20 mV/div; <150V at 10 mV/div (10 kHz or less).

DC-coupled: <350V (rms) 5 V/div to 20 mV/div; <150V at 10 mV/div (10 kHz or less).

A + B OPERATION

Amplifier: bandwidth and deflection factors are unchanged; channel B may be inverted for A — B operation.

Common Mode (A — B)

FREQUENCY: dc to 1 MHz.

REJECTION RATIO: at least 40 dB on 10 mV/div; at least 20 dB on all other ranges with verniers set for optimum rejection. Common-mode signal amplitude equivalent to 30 div.

TRIGGERING

Normal Trigger: on displayed signal.

A only trigger: on signal from channel A.

MAIN TIME BASE**SWEEP**

Ranges: from 0.1 usec/div to 2 sec/div (23 ranges) in 1, 2, 5 sequence; $\pm 3\%$ accuracy with vernier in calibrated position.

Vernier: continuously variable between all ranges, extends slowest sweep to at least 5 sec/div; vernier uncalibrated light indicates when vernier is not in CAL position.

Magnifier: expands all sweep by factor of 10 and extends fastest sweep to 10 ns/div; accuracy $\pm 5\%$ (including 3% accuracy of time base).

SWEEP MODE

Normal: sweep is triggered by internal or external signal.

Automatic: bright baseline displayed in absence of input signal; triggering is same as normal above 40 Hz.

Single: in normal mode, sweep occurs once with same triggering as normal; reset push-button arms sweep and lights indicator; in auto mode, sweep occurs once each time RESET pushbutton is pressed.

TRIGGERING

Internal: dc to 35 MHz on signals causing 0.5 div or more vertical deflection, increasing to 1 div at 75 MHz in all display modes except chop; dc to 400 kHz in chop mode.

External: dc to 35 MHz on signals 50 mV p-p or more, increasing to 100 mV p-p at 75 MHz.

External Input RC: approximately 1 megohm shunted by approximately 27 pF.

Table 1-1. Specifications (Cont'd)

Level and Slope

INTERNAL: at any point on vertical waveform displayed.

EXTERNAL: continuously variable from +1.2V to -1.2V on either slope of trigger signal. Maximum input, $\pm 100V$.

Coupling: AC, DC, LF REJ, or HF REJ.

AC: attenuates signals below approximately 20 Hz.

LF REJ: attenuates signals below approximately 15 kHz.

HF REJ: attenuates signals above approximately 30 kHz.

TRIGGER HOLDOFF: time between sweeps continuously variable.

DELAYED TIME BASE

TRACE INTENSIFICATION: intensifies that part of main time base to be expanded to full screen in delayed time base mode. Rotating time base switch from OFF position activates intensified mode.

SWEEP

Ranges: 0.1 usec/div to 0.2 sec/div (20 ranges) in 1, 2, 5 sequence; $\pm 3\%$ with vernier in calibrated position.

Vernier: continuously variable between all ranges, extends slowest sweep to 0.5 sec/div.

Magnifier: expands all sweeps by a factor of 10 and extends fastest sweep to 10 ns/div; accuracy $\pm 5\%$ (including 3% accuracy of time base).

SWEEP MODE

Trigger: delayed sweep is armed at end of delay period.

Auto: delayed sweep is automatically triggered at end of delay period.

TRIGGERING

Internal: same as main time base.

External: same as main time base. Input RC is approximately 1 megohm shunted by approximately 27 pF.

Level and Slope

INTERNAL: at any point on vertical waveform displayed.

EXTERNAL: continuously variable from +1.2V to -1.2V on either slope of trigger signal.

Coupling: selectable, AC, DC, or HF REJ. AC attenuates signals below approximately 20 Hz. HF REJ attenuates signals above approximately 30 kHz.

DELAY (Before start of delayed sweep.)

Time: continuously variable from 0.1 usec to 2 sec.

Time Jitter: $<0.005\%$ (1 part in 20,000) of maximum delay in each sweep.

Calibrated delay Accuracy: $\pm 1\%$; linearity, $\pm 0.2\%$.

MIXED SWEEP

Combines main and delayed sweeps into one display. Sweep is started by main time base and is completed by faster delayed time base.

EXTERNAL HORIZONTAL INPUT

BANDWIDTH: dc to 1 MHz.

COUPLING: dc.

DEFLECTION FACTOR: X1; 1 V/div.
X10; 0.1 V/div.

VERNIER: 10:1 vernier provides continuous adjustment between ranges.

DYNAMIC RANGE: beam may be positioned to left edge of CRT with 0 to -5V input.

MAXIMUM INPUT: $\pm 100V$.

INPUT RC: 1 megohm shunted by approximately 30 pF.

CATHODE-RAY TUBE AND CONTROLS

TYPE: post-accelerator, 22.2-kV accelerating potential; aluminized P31 phosphor (other phosphors available, refer to options).

GRATICULE: 6 X 10 div internal graticule; each major division consists of 5 subdivisions on major axes; 1 div = 1 cm.

TRACE ALIGN: aligns trace with horizontal graticule line.

BEAM FINDER: returns trace to CRT regardless of settings of vertical, horizontal, or intensity controls.

INTENSITY MODULATION: +4V, dc to 1 MHz, blanks trace of any intensity. Input R equals 1000 ohms $\pm 10\%$.

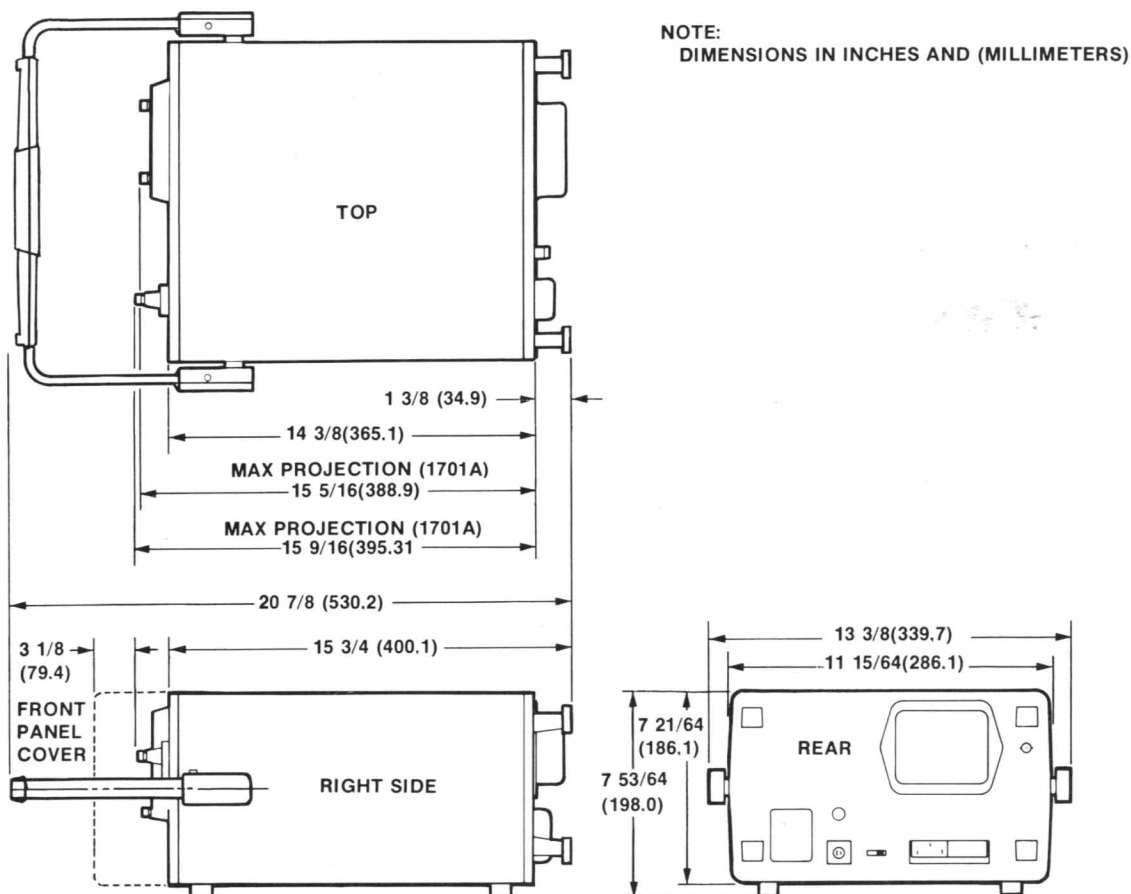
Maximum Input: 10V (dc plus pk ac).

GENERAL**CALIBRATOR**

Type: 1 kHz $\pm 10\%$ square wave.

Voltage: 1V p-p $\pm 1\%$.

Table 1-1. Specifications (Cont'd)

**POWER REQUIREMENTS**

AC Line: 115V or 230V $\pm 20\%$, 48 to 440 Hz.

DC Line: 11.5V to 36V.

Battery (optional)

OPERATING TIME: up to 4.5 hours.

RECHARGE TIME: 14 hr minimum charging time for a fully discharged battery.

LOW BATTERY INDICATOR: power light flashes to indicate that batteries are discharged and further operation may damage battery.

RECHARGING: batteries are recharging whenever POWER MODE switch is set to switch off, full charge is applied; with POWER switch ON, trickle charge is applied.

WEIGHT

Without Panel Cover: net, 24 lb (11 kg); shipping, 35 lb (15.9 kg).

With Panel Cover and Accessories: net, 27 lb (12.3 kg); shipping, 38 lb (17.2 kg).

With Panel Cover, Accessories, and Battery Pack: net, 35 lb (16 kg); shipping, 46 lb (20.9 kg).

DIMENSIONS: refer to outline drawing.

ENVIRONMENT (Oscilloscope operates within specifications over following ranges):

temperature 0°C to $+55^{\circ}\text{C}$; humidity, to 95% relative humidity to 40°C ; altitude, to 15,000 ft; vibration, in three planes for 15 min each with 0.010-inch excursion, 10 to 55 Hz.

ACCESSORIES FURNISHED: blue contrast filter, Model 10115A; front panel storage cover, Model 10101B; two Model 10006B probes; and one ac power cord with right angle plug.

1-17. CATHODE-RAY TUBE.

1-18. The Model 1707B uses a post-accelerator CRT with a nonglare, rectangular faceplate. An internal graticule is located on the same plane as the display to eliminate parallax errors. The CRT has approximately 22-kV accelerating potential, and 6 vertical by 10 horizontal divisions. Each division is a square centimeter.

1-19. A type P31 phosphor is used in the standard CRT. Other types of phosphors are available by special order. Refer to Section VII for further information about optional and special-order modifications.

NOTE

Due to phosphor burn sensitivity, instruments with a P-11 phosphor do not have the intensified function of the beam finder.

1-20. WARRANTY.

CAUTION

The warranty may be void for instruments having a mutilated serial number tag.

1-21. The instrument is certified and warranted as stated in the front of this manual. The CRT is covered by a separate warranty. The CRT warranty and warranty claim form is located at the rear of this manual. Should the CRT fail within the time specified on the CRT warranty page, complete the warranty claim form and return it with the defective CRT. The procedure for returning a defective CRT is described on CRT warranty page.

1-22. ACCESSORIES FURNISHED.

1-23. Accessories furnished are listed in table 1-1.

1-24. ACCESSORIES AVAILABLE.

1-25. Table 1-2 lists accessories available for the Model 1707B. The service kit (figure 1-3) is recommended to maintain the Model 1707B.

1-26. INSTRUMENT AND MANUAL IDENTIFICATION.

1-27. This manual applies directly to Model 1707B instruments with a serial prefix number as listed on the manual title page. The serial prefix number is the first group of digits in the instrument serial number (figure 1-2). The instrument serial number is on a tag located on the rear panel.

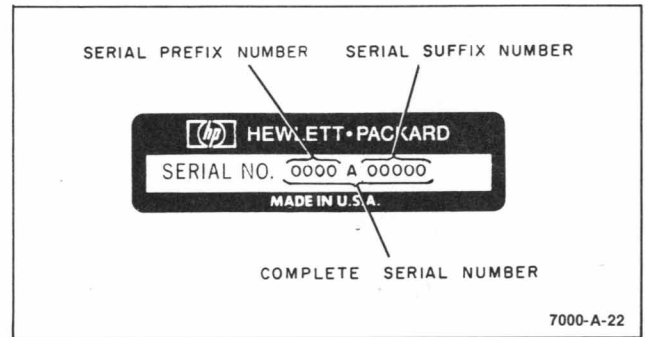


Figure 1-2. Instrument Serial Number

1-28. Check the serial prefix number of the instrument. If the serial prefix number is different from that listed on the title page of this manual, refer to Section VII for instructions to adapt this manual for proper instrument coverage.

1-29. Technical corrections to the manual are listed under errata on an enclosed MANUAL CHANGES sheet (if any).

1-30. INQUIRIES.

1-31. Refer any questions regarding the manual, the change sheet or the instrument to the nearest HP Sales/Service Office. Always identify the instrument by model number, complete name and complete serial number in all correspondence. Refer to the rear of the manual for a world-wide listing of HP Sales/Service Offices.

Table 1-2. Model 1707B Accessories Available

Accessory No.	Description
HP Model 10102A	RFI Contrast Screen
HP Model 10103B	Battery Pack
HP Model 10104A	Viewing Hood (collapsible)
HP Model 10105A	Testmobile Adapter
HP Model 10106A	Camera Adapter
HP 01701-68701	Service Kit; contains three extender boards and one board puller.
HP Model 10036A	Probe Adapter Kit: probe tips contained in kit are designed for use with probes supplied with 1700-series oscilloscopes.

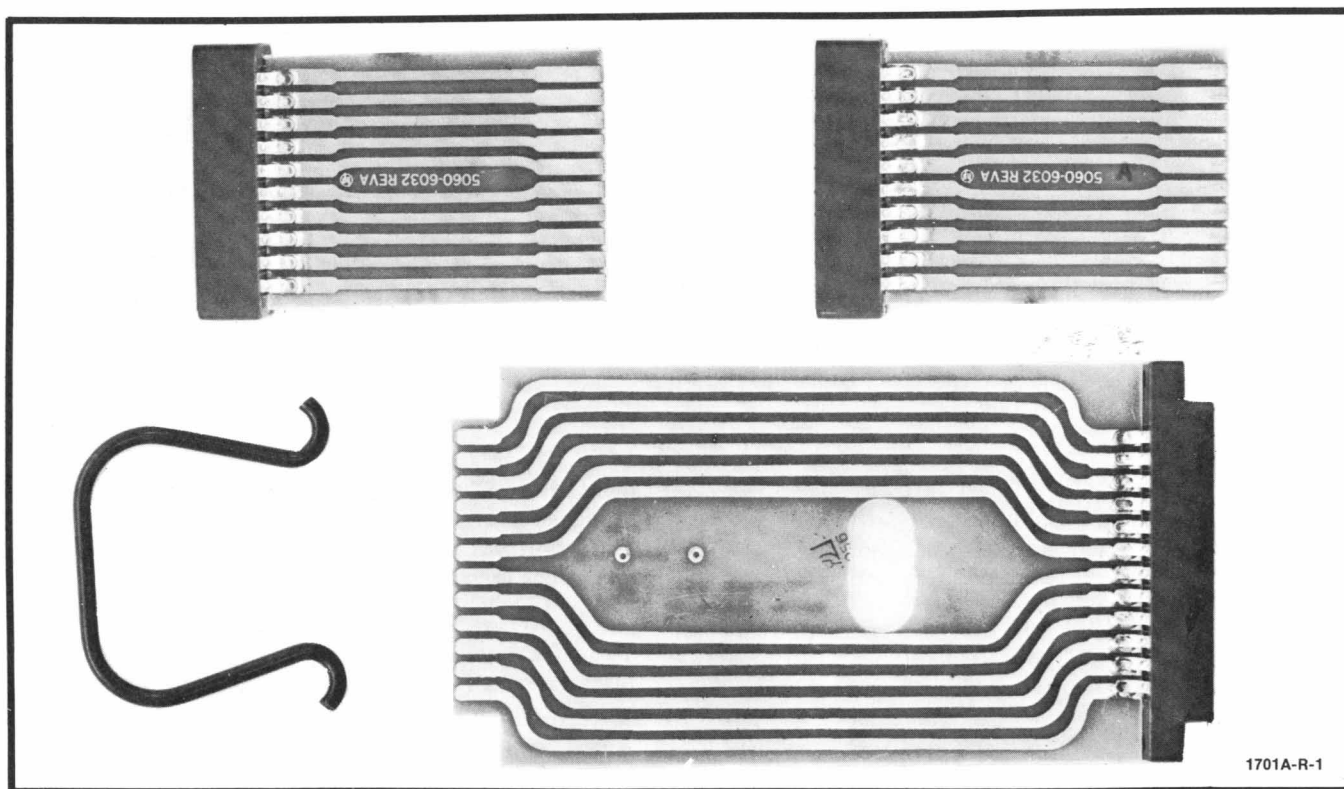


Figure 1-3. Service Kit for HP 1700-series Oscilloscopes

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains instructions for performing an initial inspection of the Model 1707B. Installation procedures and precautions are presented in step-by-step order. The procedures for making a claim for warranty repairs and for repacking the instrument for shipment are also described in this section.

2-3. INITIAL INSPECTION.

2-4. The instrument was inspected mechanically and electrically before shipment. Upon receipt, inspect it for damage that may have occurred in transit. Check for broken knobs, bent or broken connectors, and dents or scratches. If damage is found, refer to the claims paragraph in this section. Retain the packing material for possible future use.

WARNING

Voltages are present inside instrument when power switch is off and ac power cord connected.

2-5. Check the electrical performance of the instrument immediately after receipt. Refer to Section V for the performance check procedure. The performance check will determine whether or not the instrument is operating within the specifications listed in table 1-1. Initial performance and accuracy of the instrument are certified as stated in the front of this manual. If the instrument does not operate as specified, refer to the claims paragraph in this section.

2-6. PREPARATION FOR USE.

2-7. POWER REQUIREMENTS.

2-8. The Model 1707B can operate from either an ac or dc power source. For ac operation, the Model 1707B requires 115- or 230-volt $\pm 20\%$, single phase, 48- to 440-Hz source that can deliver 50 volt-amperes.

2-9. A slide switch inside the rear panel power module (figure 2-1), on the rear panel, determines 115- or 230-volt operation. To check or change the position of this slide switch, proceed as follows:

a. Turn instrument off and remove power cord from rear panel.

b. Move plastic cover to left (figure 2-1).

c. Pull out lever under fuse. This removes fuse (0.5 AT for 115V operation) from instrument.

d. Check to see that slide switch (figure 2-1) is to right for 115V operation.

e. For 230V operation, move slide switch to left and install 0.25 AT fuse.

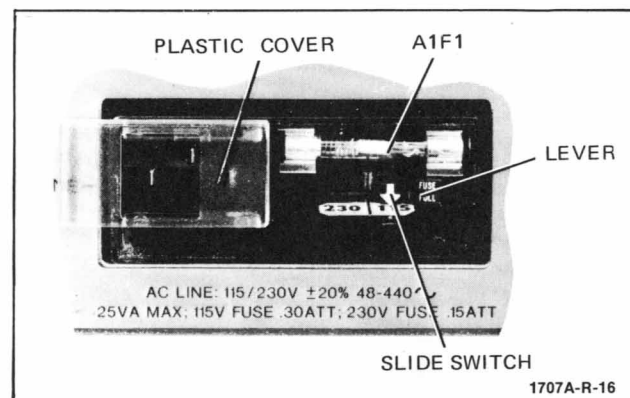


Figure 2-1. Rear Panel Power Module

2-10. For dc operation, the Model 1707B requires from 11.5 to 36 volts, 25 watts maximum. The 2 amp dc line fuse (F1) must be replaced with a 3 amp fuse for DC LINE operation. The instrument can also be operated from a battery pack. Depending on the power mode of operation, the POWER MODE switch (on rear panel) should be set to one of three positions: DC LINE, INTERNAL BATTERY, or AC LINE.

CAUTION

Do not change the POWER MODE switch setting with the instrument on or with ac or dc power applied to the rear panel.

- a. Turn instrument power off.
- b. Disconnect ac or dc power cord from rear panel.
- c. Set POWER MODE switch to desired position.
- d. Connect ac or dc power cord if desired.
- e. Turn instrument power on.

2-11. THREE-CONDUCTOR AC POWER CABLE.

2-12. For the protection of operating personnel, Hewlett-Packard Company recommends that the instrument panel and cabinet be grounded. This in-

strument is equipped with a three-conductor ac power cable that, when connected to an appropriate receptacle, grounds the instrument through the offset pin. The power jack and mating plug of the power cord meet International Electro-technical Commission (IEC) safety standards. To preserve this protection feature when operating from a two-contact outlet, use a three-conductor to two-conductor adapter, and connect the adapter wire to ground at the power outlet.

2-13. DC PLUG.

2-14. A dc jack is provided for operating from a dc line. The cable used for the dc power cord should be 2 wire (grounded) and must be able to carry 2.5A of current with a voltage loss of less than 1 volt.

2-15. BATTERY INSTALLATION.

2-16. To install the battery pack in the Model 1707B, proceed as follows:

CAUTION

Read operating note on battery pack before installation.

- a. Turn instrument off and remove power cord from rear of instrument.
- b. Move POWER MODE switch to INTERNAL BATTERY position.
- c. Turn instrument on its top and loosen fasteners holding bottom cover.
- d. Remove bottom cover.
- e. Place battery pack in instrument as shown in figure 2-2.

NOTE

Use only HP Model 10103B Battery Pack with the Model 1707B.

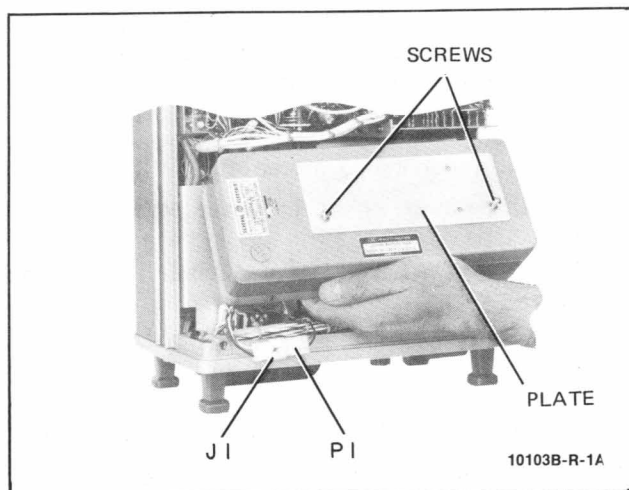


Figure 2-2. Battery Pack Installation

- f. Install two battery screws (figure 2-2).
- g. Connect P1 to J1 (figure 2-2).
- h. Replace bottom cover and tighten fasteners.
- i. Turn instrument right side up.

CAUTION

If power light is flashing, battery is discharged. Damage to the battery may occur if operated in this condition. Refer to Section III for battery recharging operation.

- j. Turn instrument on and observe power light. If power light is on, resume normal operation.

2-17. CLAIMS

2-18. The warranty statement applicable to this instrument is printed in the front of this manual. Refer to the front of this manual for the CRT warranty statement also. If physical damage is found or if operation is not as specified when the instrument is received, notify the carrier and the nearest Hewlett-Packard Sales/Service Office immediately (refer to the list in back of this manual for addresses). The HP Sales/Service Office will arrange for repair or replacement without waiting for settlement of the claim with the carrier.

2-19. REPACKING FOR SHIPMENT.

2-20. If the Model 1707B is to be shipped to a Hewlett-Packard Sales/Service Office for service or repair, attach a tag showing owner (with address), complete instrument serial number, and a description of the service required.

2-21. Use the original shipping carton and packing material. If the original packing material is not available, the HP Sales/Service Office will provide information and recommendations on materials to be used. Materials used for shipping an instrument normally include the following:

- a. A double-walled carton with a test strength of about 300 lb.
- b. Heavy paper or sheets of cardboard to protect all instrument surfaces; use a nonabrasive material such as polyurethane or cushioned paper such as Kimpak around projecting parts.
- c. At least 4 inches of tightly-packed, industry-approved, shock-absorbing material such as extra-firm polyurethane foam.
- d. Heavy-duty shipping tape for securing outside of carton.

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section provides general operating instructions and applications information for the Model 1707B. Front-and rear-panel controls and connectors are identified and briefly described in figure 3-1. Operational adjustments are shown in figures 3-3 and 3-4 and general operating instructions are shown in figures 3-5 through 3-7.

3-3. CONTROLS AND CONNECTORS.

3-4. The following paragraphs explain some of the controls and connectors in detail.

3-5. BEAM FINDER.

3-6. Pressing this pushbutton increases intensity and reduces amplifier gain enough to return beam to viewing area. This enables the operator to locate beam and determine the action necessary to center a display (examples: reduce input signal amplitude, change coupling, adjust deflection factor, trigger level, dc balance, position controls, or intensity). When centered properly, the beam remains on the CRT when the pushbutton is released.

NOTE

Due to phosphor burn sensitivity, instruments with a P11 phosphor do not have the intensified function of the beam finder.

3-7. SCALE ILLUMINATION.

3-8. This control adjusts the overall brightness of the CRT graticule. It should be adjusted for good contrast between the background and graticule. The SCALE ILLUM control is especially useful when using a hood to view the display or when photographing waveforms. Rotate the control to OFF when scale illumination is not needed.

3-9. TRACE ALIGN.

3-10. The TRACE ALIGN adjustment compensates for external magnetic fields that may affect the alignment of the horizontal trace with the graticule. The alignment should be checked when the instrument is moved to a new location and adjustment made whenever necessary.

3-11. CALIBRATOR.

3-12. The 1-volt, 1-kHz square wave output of the calibrator can be used for vertical sensitivity calibration and for divider probe compensation. The amplitude accuracy is $\pm 1\%$ and the frequency accuracy is $\pm 10\%$.

3-13. FOCUS AND ASTIGMATISM.

3-14. Both of these controls are used to obtain a sharp display. Normally, the ASTIGMATISM control need not be readjusted once it is set.

3-15. COUPLING.

3-16. This lever switch selects either capacitive (AC) or direct (DC) coupling of the input signal to the amplifier, or it grounds (GND) the amplifier input stage while disconnecting the input signal. The switch should be positioned to DC when viewing long duration pulses or dc levels of waveforms. AC should be selected when viewing ac waveforms having large dc levels. GND position is used to disconnect the signal source from the input of the amplifier and at the same time grounds the input of the amplifier. It is useful to use GND position to establish a zero volt reference.

3-17. DISPLAY.

3-18. This switch selects the type of display. Input signals may be displayed either singly or simultaneously as explained below.

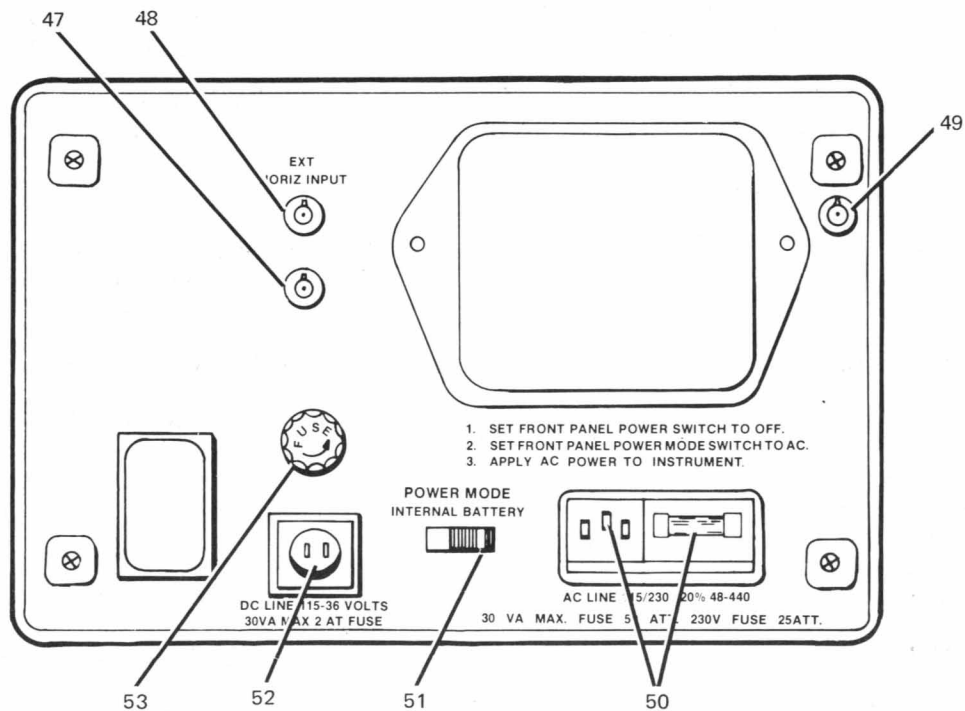
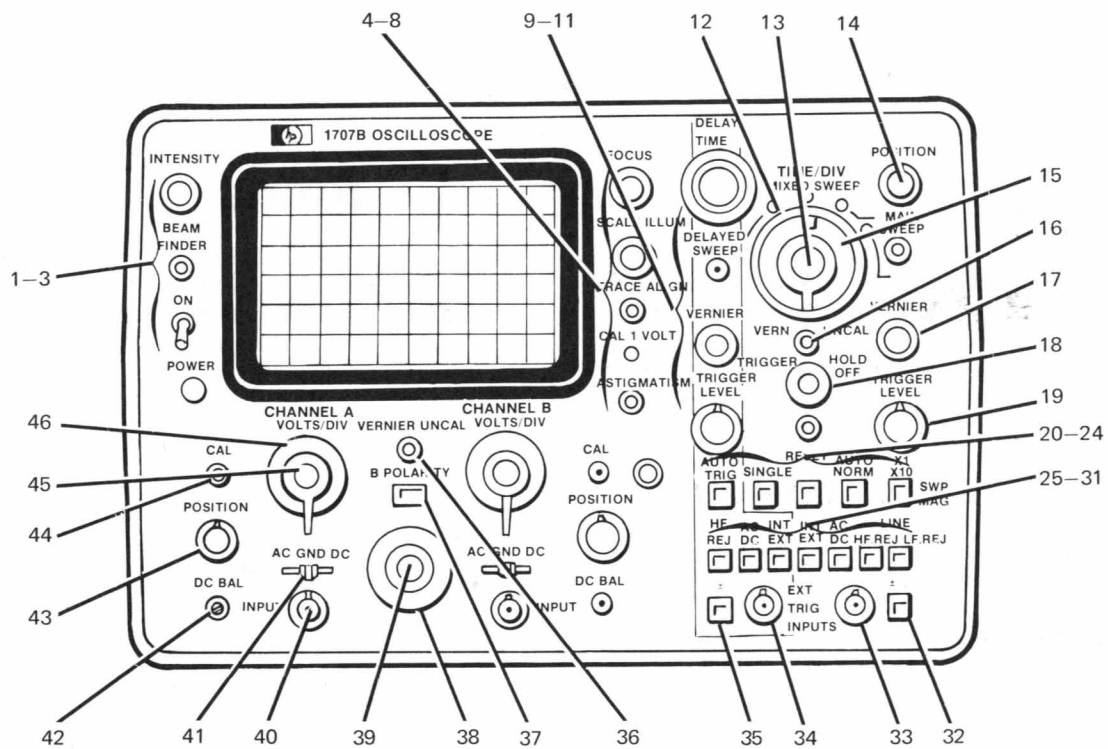
3-19. Position A displays channel A input signals.

3-20. Position B displays channel B input signals.

3-21. Position A+B displays the algebraic sum of the channel A and channel B input signals.

3-22. CHOP position presents a separate display of each input. Both inputs are displayed during the same sweep by switching between each channel at a rate of 400 kHz. This mode should be used to display low frequency signals. A ONLY TRIG should be used in the CHOP mode for stable triggering.

3-23. ALT position presents each channel on alternate sweeps. This mode should be used to display high frequency signals. If the channel A and B signals are time related, A ONLY TRIG will provide



1707B-R-7A

Figure 3-1. Controls and Connectors

1. INTENSITY. Controls brightness of display.	16. VERNIER UNCAL. Lights when either main or delayed VERNIER is not in CAL position.	27. INT/EXT. Selects internal or external sweep triggering for delayed sweeps.	b. NORM TRIG. Instrument triggers on displayed signal except in ALT mode. ALT mode is triggered on composite sync (LF REJ must be used to maintain proper triggering).
2. BEAM FINDER. Returns display to viewing area.	17. main VERNIER. Provides continuous control of sweep between calibrated positions of main TIME/DIV switch.	28. INT/EXT. Selects internal or external sweep triggering for main sweep.	
3. POWER-ON. Toggle switch for turning oscilloscope on and off. Light illuminates when power is on. Light flashes when optional battery is discharged.	18. TRIGGER HOLDOFF. Provides continuous control of time between sweeps. NORM holdoff time is minimum.	29. AC/DC. Selects main sweep trigger signal coupling.	40. INPUT. Input signal connects to BNC connector.
4. FOCUS. Adjusts writing beam for sharpest trace.	19. main TRIGGER LEVEL. Selects amplitude point on trigger signal that starts main sweep.	30. HF REJ. Attenuates main sweep trigger signals above 30 kHz.	41. coupling. Selects capacitive (AC) or direct (DC) coupling of input signal, or grounds (GND) amplifier stage.
5. SCALE ILLUM. Controls brightness of scale illumination.	20. AUTO/TRIG.	31. LF REJ. Attenuates main sweep trigger signals below 15 kHz.	42. DC BAL. Adjust to minimize vertical shift of trace when vernier is rotated.
6. TRACE ALIGN. Adjust to align trace with horizontal graticule line.	a. AUTO. Delayed sweep starts automatically at end of delay time.	NOTE Depressing both HF REJ and LF REJ selects a LINE SYNC mode of triggering.	
7. CAL 1 VOLT. provides 1-kHz square wave at 1 volt $\pm 1\%$.	b. TRIG. Delayed sweep arms at end of delay time and is ready to be triggered either internally or externally.		
8. ASTIGMATISM. Adjusts roundness of writing spot.	21. SINGLE. Selects single or normal sweep operation.	32. main slope. Selects slope of main trigger signal that starts sweep.	43. POSITION. Varies vertical position of display.
9. DELAY TIME. Selects time delay between start of main sweep and start of delayed sweep.	22. RESET. Resets sweep in SINGLE sweep mode; reset light indicates when sweep is armed.	33. EXT TRIG INPUTS. Main sweep external trigger input.	44. CAL. Adjust to calibrate amplifier with setting of VOLTS/DIV switch.
10. delayed VERNIER. Provides continuous control of sweep time between calibrated positions of delayed TIME/DIV switch.	23. AUTO/NORM.	34. EXT TRIG INPUTS. Delayed sweep external trigger input.	45. vernier. Provides continuous adjustments of volts/div between calibrated positions of VOLTS/DIV switch.
11. delayed TRIGGER LEVEL. Selects amplitude point on trigger signal that starts delayed sweep.	a. AUTO. Automatic sweep in absence of trigger signal or triggered sweep by applying trigger signal above 40 Hz rate.	35. delayed slope. Selects slope of delayed sweep trigger signal.	46. VOLTS/DIV. Selects vertical deflection factor necessary for calibrated measurements
12. delayed TIME/DIV. Controls sweep time in DELAYED mode. Controls intensified portion of sweep in MAIN mode.	b. NORM. Main sweep is triggered only by applying trigger signal.	36. VERNIER UNCAL. Lights when either vernier control is out of full clockwise CAL detent position.	47. ext horiz VERNIER. Permits 10:1 horizontal amplifier gain.
13. sweep display. Selects MAIN, DELAYED or MIXED SWEEP, or EXT HORIZ INPUT.	24. SWP MAG. In X10 position, sweep is magnified ten times.	37. B POLARITY. Controls channel B polarity.	48. EXT HORIZ INPUT. Input to external amplifier.
14. HORIZONTAL POSITION. Controls coarse and fine horizontal position of display.	25. HF REJ. Attenuates delayed sweep trigger signals above 30 kHz.	38. DISPLAY. Selects display mode of channel A, B, A-B, CHOP or ALT.	49. Z AXIS INPUT. Z-axis input connector.
15. main TIME/DIV. Controls sweep time in MAIN SWEEP mode.	26. AC/DC. Selects delayed sweep trigger signal coupling.	39. trig.	50. AC LINE. Power input from ac line. Power module contains ac line fuse (0.50 amp slow-blow for 125V, 0.25 amp slow-blow for 230V) and line selector switch.
		a. A ONLY TRIG. Internal trigger signal is derived from channel A.	51. POWER MODE. Selects dc line, ac line or internal battery operation.
			52. DC LINE. Power input for dc line operation.
			53. FUSE. 2 amp slow-blow fuse for all modes of operation except DC LINE (3 amp used in DC LINE).

Figure 3-1.
Controls and Connectors (Cont'd)
3-3

1. INTENSITY. Controls brightness of display.
2. BEAM FINDER. Returns display to viewing area.
3. POWER-ON. Toggle switch for turning oscilloscope on and off. Light illuminates when power is on. Light flashes when optional battery is discharged.
4. FOCUS. Adjusts writing beam for sharpest trace.
5. SCALE ILLUM. Controls brightness of scale illumination.
6. TRACE ALIGN. Adjust to align trace with horizontal graticule line.
7. CAL 1 VOLT. provides 1-kHz square wave at 1 volt $\pm 1\%$.
8. ASTIGMATISM. Adjusts roundness of writing spot.
9. DELAY TIME. Selects time delay between start of main sweep and start of delayed sweep.
10. delayed VERNIER. Provides continuous control of sweep time between calibrated positions of delayed TIME/DIV switch.
11. delayed TRIGGER LEVEL. Selects amplitude point on trigger signal that starts delayed sweep.
12. delayed TIME/DIV. Controls sweep time in DELAYED mode. Controls intensified portion of sweep in MAIN mode.
13. sweep display. Selects MAIN, DELAYED or MIXED SWEEP, or EXT HORIZ INPUT.
14. HORIZONTAL POSITION. Controls coarse and fine horizontal position of display.
15. main TIME/DIV. Controls sweep time in MAIN SWEEP mode.
16. VERNIER UNCAL. Lights when either main or delayed VERNIER is not in CAL position.
17. main VERNIER. Provides continuous control of sweep between calibrated positions of main TIME/DIV switch.
18. TRIGGER HOLDOFF. Provides continuous control of time between sweeps. NORM holdoff time is minimum.
19. main TRIGGER LEVEL. Selects amplitude point on trigger signal that starts main sweep.
20. AUTO/TRIG.
 - a. AUTO. Delayed sweep starts automatically at end of delay time.
 - b. TRIG. Delayed sweep arms at end of delay time and is ready to be triggered either internally or externally.
21. SINGLE. Selects single or normal sweep operation.
22. RESET. Resets sweep in SINGLE sweep mode; reset light indicates when sweep is armed.
23. AUTO/NORM.
 - a. AUTO. Automatic sweep in absence of trigger signal or triggered sweep by applying trigger signal above 40 Hz rate.
 - b. NORM. Main sweep is triggered only by applying trigger signal.
24. SWP MAG. In X10 position, sweep is magnified ten times.
25. HF REJ. Attenuates delayed sweep trigger signals above 30 kHz.
26. AC/DC. Selects delayed sweep trigger signal coupling.

- 27. INT/EXT. Selects internal or external sweep triggering for delayed sweeps.
- 28. INT/EXT. Selects internal or external sweep triggering for main sweep.
- 29. AC/DC. Selects main sweep trigger signal coupling.
- 30. HF REJ. Attenuates main sweep trigger signals above 30 kHz.
- 31. LF REJ. Attenuates main sweep trigger signals below 15 kHz.

NOTE

Depressing both HF REJ and LF REJ selects a LINE SYNC mode of triggering.

- 32. main slope. Selects slope of main trigger signal that starts sweep.
- 33. EXT TRIG INPUTS. Main sweep external trigger input.
- 34. EXT TRIG INPUTS. Delayed sweep external trigger input.
- 35. delayed slope. Selects slope of delayed sweep trigger signal.
- 36. VERNIER UNCAL. Lights when either vernier control is out of full clockwise CAL detent position.
- 37. B POLARITY. Controls channel B polarity.
- 38. DISPLAY. Selects display mode of channel A, B, A+B, CHOP or ALT.
- 39. trig.
 - a. A ONLY TRIG. Internal trigger signal is derived from channel A.
 - b. NORM TRIG. Instrument triggers on displayed signal except in ALT mode. ALT mode is triggered on composite sync (LF REJ must be used to maintain proper triggering).
- 40. INPUT. Input signal connects to BNC connector.
- 41. coupling. Selects capacitive (AC) or direct (DC) coupling of input signal, or grounds (GND) amplifier stage.
- 42. DC BAL. Adjust to minimize vertical shift of trace when vernier is rotated.
- 43. POSITION. Varies vertical position of display.
- 44. CAL. Adjust to calibrate amplifier with setting of VOLTS/DIV switch.
- 45. vernier. Provides continuous adjustments of volts/div between calibrated positions of VOLTS/DIV switch.
- 46. VOLTS/DIV. Selects vertical deflection factor necessary for calibrated measurements
- 47. ext horiz VERNIER. Permits 10:1 horizontal amplifier gain.
- 48. EXT HORIZ INPUT. Input to external amplifier.
- 49. Z AXIS INPUT. Z-axis input connector.
- 50. AC LINE. Power input from ac line. Power module contains ac line fuse (0.50 amp slow-blow for 125V, 0.25 amp slow-blow for 230V) and line selector switch.
- 51. POWER MODE. Selects dc line, ac line or internal battery operation.
- 52. DC LINE. Power input for dc line operation.
- 53. FUSE. 2 amp slow-blow fuse for all modes of operation except DC LINE (3 amp used in DC LINE).

the most stable triggering. If the two signals are not time related, then NORM TRIG should be used.

3-24. TRIG.

3-25. This switch selects the signal to be used as the internal trigger signal. In A ONLY TRIG position, the signal on channel A is used as the internal trigger signal. In NORM TRIG position, the instrument triggers on the signal being displayed, except in ALT mode. In ALT mode, the instrument triggers on the composite sync signal and LF REJ trigger coupling should be used to maintain stable triggering.

3-26. B POLARITY.

3-27. This switch inverts the channel B display 180 degrees. This switch can also be used to present an A-B display. Set DISPLAY to A+B mode. Put B POLARITY switch in INVT position. Display observed is A-B.

3-28. SWEEP DISPLAY.

3-29. This switch, mounted concentric to the main and delayed TIME/DIV controls, determines the horizontal sweep display modes. Modes are EXT HORIZ INPUT, MAIN SWEEP, MIXED SWEEP and DELAYED SWEEP. The function of each mode is as follows:

3-30. EXT HORIZ INPUT.

3-31. In this mode, the CRT horizontal plates are driven by an external source.

3-32. MAIN SWEEP.

3-33. In this mode, the main sweep sets a time base reference for the vertical signal. Main sweep controls are mounted on the right side of the front panel, and sweep speed is selected by main TIME/DIV. If delayed TIME/DIV is set to OFF, sweep intensity is uniform. However, any other setting of delayed TIME/DIV causes the sweep to intensify during the time that the delayed sweep is generated. This feature makes it possible to select a point of interest on the main sweep time base before viewing in the delayed sweep mode.

3-34. MIXED SWEEP.

3-35. In this mode, the first portion of signal is referenced to the main time base and the expanded portion is referenced to the delayed time base. Turning the DELAY TIME control varies the amount of display controlled by the delayed time base.

3-36. DELAYED SWEEP.

3-37. Main sweep is not displayed in this mode. The sweep speed is controlled by delayed TIME/DIV.

3-38. TIME/DIV.

3-39. Main and delayed TIME/DIV switches determine the amount of time to sweep horizontally one graticule division. Both switches are concentric and interlocked so the delayed sweep is always faster than the main sweep. Main sweep speeds are selectable by main TIME/DIV in 23 ranges from 0.1 usec/div to 2 sec/div. Twenty ranges of delayed sweep speeds from 0.1 usec/div to 0.2 sec/div are provided by delayed TIME/DIV. By using the SWP MAG switch, a display can be expanded 10 times, increasing the fastest sweep to 10 ns/div.

3-40. VERNIER.

3-41. Sweep speeds are calibrated to the TIME/DIV switch when both the main and delayed VERNIER controls are set fully clockwise to the CAL detent position. As the VERNIER controls are turned counterclockwise, the VERNIER UNCAL indicator lights and sweep speeds decrease. The main VERNIER control extends the slowest sweep to at least 5 sec/div. The vernier controls are useful for making continuous adjustments of sweep speed, however, TIME/DIV readings are uncalibrated.

3-42. TRIGGER LEVEL.

3-43. These controls select the point on the sync signal that starts the sweep. Triggering point is adjustable at any level on the displayed signal in INT position. In the EXT position, the triggering point is adjustable from +1.2V to -1.2V along the sync signal. Delayed TRIGGER LEVEL has no function when AUTO/TRIG is set to AUTO.

3-44. TRIGGER HOLDOFF.

3-45. This adjustment is a dual purpose control. When the control is rotated out of detent position, the first portion of the control acts as a high frequency stability control. This prevents double triggering on high frequency waveforms. As the control is rotated further out of detent position, it functions as a trigger holdoff and allows the instrument to synchronize on complex waveforms.

3-46. SLOPE.

3-47. These switches determine whether the sweep triggers on the positive-going (+) or negative-going (—) portion of the sync signal. When the AUTO/TRIG is set to AUTO, the delayed slope control has no function.

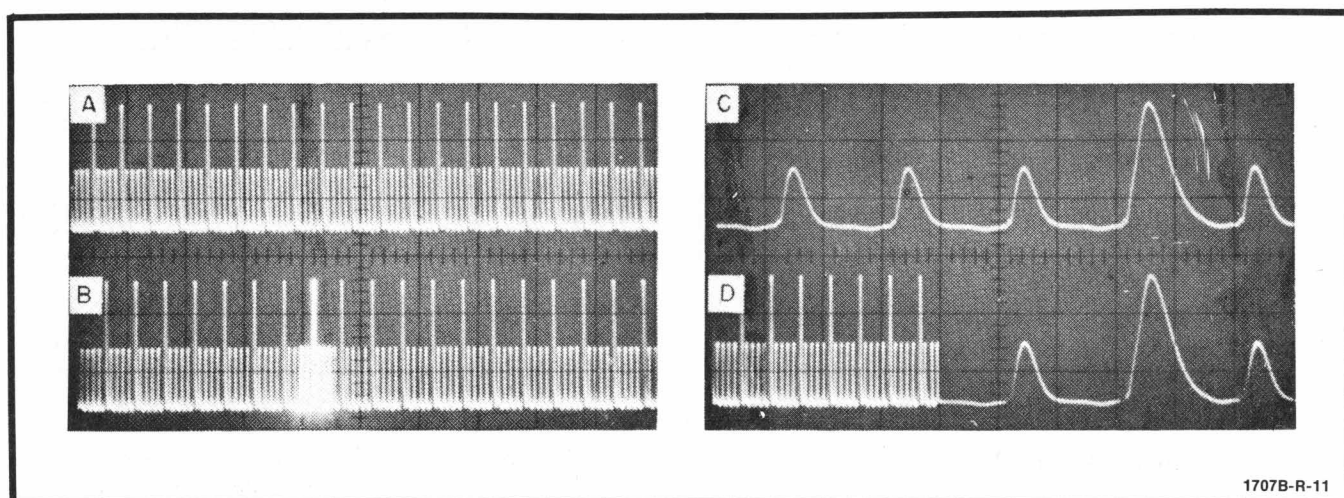


Figure 3-2. Sweep Combinations

3-48. SWEEP MODE.

3-49. This group of switches selects the type of main and delayed sweep triggering. Main sweep free runs in AUTO, giving a bright base line in the absence of a sync signal. However, if a sync signal of 40 Hz or greater is applied, it overrides free-run operation and triggers the sweep. Due to the presence of a base line, the auto sweep mode can be used for most applications. Use NORM if the sync signal is erratic or is less than 40 Hz. The sync input signal is always needed in NORM to generate a sweep. When the SINGLE pushbutton is engaged, the sweep is generated only once. To sweep again, push RESET pushbutton and release. This arms the sweep circuit. This feature is particularly useful for viewing or photographing single transient waveforms.

3-50. When AUTO/TRIG is set to AUTO, the delayed sweep starts at the end of the delay time. When AUTO/TRIG is set to TRIG, the delayed sweep is started by the first sync signal after the delay time.

3-51. TRIGGER SELECTION.

3-52. Main and delayed trigger source is selected by this group of switches. In the INT position, sweep is synchronized to the vertical deflection signal. When EXT is selected, the sweep is triggered by sync signals applied to the EXT TRIG INPUTS connector.

3-53. The trigger coupling switches determine the type of main and delayed sync coupling. Direct coupling (DC) is normally used for sync signals from dc to less than 20 Hz. Capacitive coupling (AC) blocks the dc component of a sync signal and passes only the ac component. AC coupling does, however, attenuate signals below 20 Hz. The LF REJ switch attenuates signals below approximately 15 kHz and is used, for example, to prevent power line or other low frequency signals from triggering the sweep. The delayed trigger circuits do not have a LF REJ switch.

The HF REJ switch attenuates signals above approximately 30 kHz and can be used to prevent high frequency noise from triggering the sweep.

3-54. MAGNETIC INTERFERENCE.

3-55. The CRT is provided with a mu-metal shield for protection against magnetic fields. Due to the sensitivity of the CRT, it is possible that strong magnetic fields from nearby motors, ac line transformers, etc., may still result in noticeable beam deflection. In this event, reorient or relocate the instrument with respect to the interfering device.

3-56. BATTERY RECHARGE OPERATION.**NOTE**

Use only the HP Model 10103B Battery Pack with the Model 1707B.

3-57. To recharge Model 10103B Battery Pack, proceed as follows:

- a. Set front panel POWER switch to off.
- b. Set rear panel POWER MODE switch to AC LINE.
- c. Connect ac power to the instrument. This sends 400 milliamperes of charge current to the battery. Recharge time is approximately 14 hours. (With the ac POWER switch set to ON, a trickle charge of approximately 40 mA is applied to the battery.)

3-58. PREOPERATIONAL ADJUSTMENTS.**3-59. INITIAL TURN-ON.**

3-60. To place the Model 1707B into operation, perform the following steps:

- a. Set INTENSITY to full counterclockwise.

- b. Set vertical POSITION A and B to midrange.
- c. Set DISPLAY to desired mode of operation.
- d. Set VOLTS/DIV to 5V.
- e. Set channel A and B verniers to CAL detent.
- f. Place B POLARITY to NORM.
- g. Set vertical coupling channel A and B to GND.
- h. Set HORIZONTAL POSITION to midrange.
- i. Set main TIME/DIV to 1 mSEC.
- j. Set delayed TIME/DIV to OFF.
- k. Set main and delayed VERNIER to CAL detent.
- l. Set main AUTO/NORM to AUTO.
- m. Set main INT/EXT to INT.
- n. Set sweep display to MAIN sweep.

CAUTION

Verify proper position of POWER MODE switch located on rear panel.

- o. Apply operating power and allow 15 minutes warmup time.

- p. Set INTENSITY so that trace is just visible.

- q. Connect signal(s) and proceed with measurements.

3-61. FOCUS AND ASTIGMATISM ADJUST.

3-62. To adjust FOCUS and ASTIGMATISM proceed as follows:

- a. Set all pushbuttons out.
- b. Set Model 1707B channel A controls as follows:

VOLTS/DIV 01
 DISPLAY A
 POSITION center trace on CRT

- c. Set main TIME/DIV to .2 SEC.
- d. Turn main vernier full ccw.
- e. Set INTENSITY to observe dot.
- f. Adjust FOCUS and ASTIGMATISM controls for best defined dot, as dot moves slowly across CRT.

3-63. OPERATING PROCEDURES.

3-64. Figure 3-5 through 3-7 are operating plates containing step-by-step operating procedures indexed to photographs.

3-65. OPERATORS PERFORMANCE CHECK.

3-66. The operation of the Model 1707B may be checked without use of additional test equipment by using the CAL 1 VOLT output as a signal source. These operating tests will functionally check each of the display modes and the front-panel controls. To check specifications listed in table 1-1, refer to Section V for performance checks. The operation check must be performed in the sequence given. Do not attempt to start a procedure in mid-sequence, as succeeding steps depend on control settings and results of previous steps. If any of the results are unobtainable, refer to Section V, Performance Checks and Adjustment Procedure, or Section VIII, Schematics and Troubleshooting.

- a. Set Model 1707B controls as follows:

channel A VOLTS/DIV	.02
channel A coupling	A
channel A vernier	CAL
DISPLAY	A
trig	A ONLY TRIG
B POLARITY	NORM
main VERNIER	CAL
delayed VERNIER	CAL
sweep display	MAIN SWEEP
main TIME/DIV	.5 mSEC
delayed TIME/DIV	OFF
DELAY TIME	3.00
AUTO/NORM	AUTO
AUTO/TRIG	AUTO
main INT/EXT	INT
delayed INT/EXT	INT
delayed slope	+
main slope	+
main TRIGGER LEVEL	as required
	for stable triggering
TRIGGER HOLDOFF	NORM
SWP MAG	X1

- b. Set INTENSITY, FOCUS and POSITION controls for desired display in center of screen.

- c. Connect CAL 1 VOLT output to channel A INPUT using the X10 probe.

- d. Adjust main TRIGGER LEVEL for stable display. Observe approximately 5 positive-going pulses with an amplitude of 5 div.

- e. Set delayed TIME/DIV to .2 mSEC. Observe intensified portion of sweep.

NOTE

Intensified portion should cover 4 to 5 divisions.

f. Adjust DELAY TIME until intensified portion is centered on CRT.

g. Set sweep display switch to DELAYED SWEEP. Observe that intensified portion is expanded to full 10 divisions.

h. Set sweep display switch to MAIN SWEEP.

i. Vary DELAY TIME control. Observe that intensified portion moves smoothly along display.

j. Set delayed AUTO/TRIG control to TRIG.

k. Adjust delayed TRIGGER LEVEL for stable intensified portion of the trace.

l. Vary DELAY TIME control. Observe that leading edge of intensified portion jumps from one positive slope leading edge to next.

m. Set delayed TIME/DIV to OFF.

n. Rotate main VERNIER counterclockwise to stop. Observe 15 or more pulses between first and eleventh graticule lines.

o. Disconnect calibrator signal from vertical amplifier.

p. Set main TIME/DIV to .1 SEC.

q. Set main TRIGGER LEVEL to full clockwise position.

r. Set main AUTO/NORM to NORM.

s. Select SINGLE operation.

t. Press RESET pushbutton. Reset indicator should go on. Observe no sweep.

u. Rotate main TRIGGER LEVEL to full counterclockwise position. Observe one sweep and reset indicator goes off after sweep.

v. Set AUTO/NORM to AUTO.

w. Press RESET pushbutton. Observe one sweep.

3-67. OPERATING INFORMATION.

3-68. The following paragraphs provide additional information concerning the use of some specific functions.

3-69. AUTO VERSUS NORM.

3-70. In AUTO operation, there will always be a base line. A trigger signal of 40 Hz or higher overrides AUTO operation and produces a stable presentation. Adjustment of main TRIGGER LEVEL may be necessary for a stable display. If the trigger is less than 40 Hz, or if it is unstable, NORM operation should be used. A trigger signal is always needed in NORM operation to generate a sweep.

3-71. AUTO VERSUS TRIG.

3-72. Auto delayed sweep operation is achieved when AUTO/TRIG pushbutton is out. This causes the delayed sweep to start at the end of delayed time as set by the DELAY TIME control.

3-73. AC VERSUS DC.

3-74. Ac coupling removes the dc level of trigger signals operations. Use of the LF REJ control prevents low frequency noise from triggering the sweep.

3-75. MIXED SWEEP.

3-76. In this mode, the first part of the presentation is displayed on a time base set by the main TIME/DIV switch. The last part of the presentation is displayed on a time base set by the delayed TIME/DIV switch. The delay between the start of the main sweep and the start of the delayed sweep is determined in part by the DELAY TIME control.

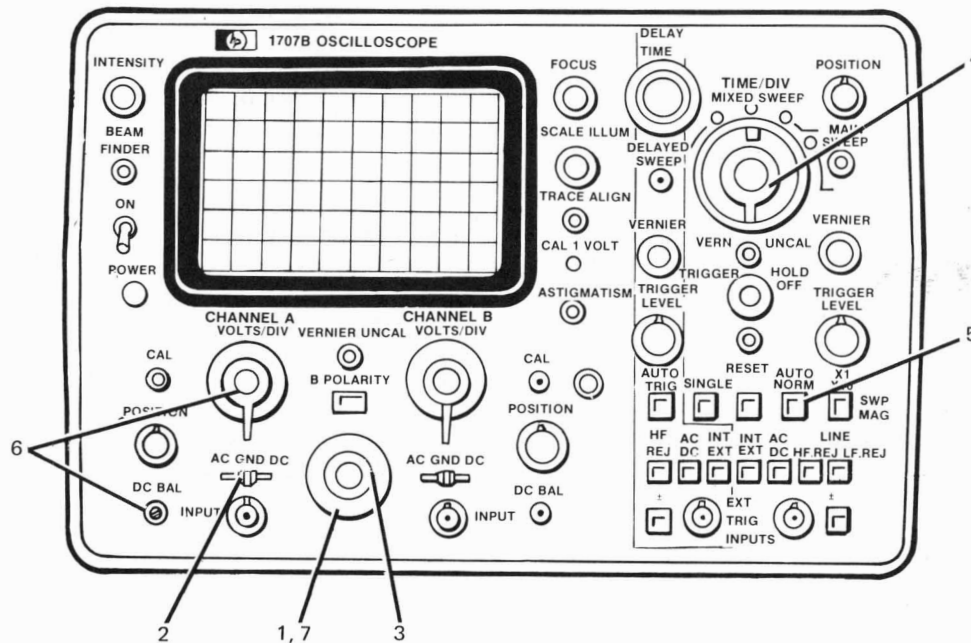
3-77. DELAYED SWEEP.

3-78. Signals can be displayed at 100 ns/div with 3% accuracy. Displays can also be expanded up to 10 ns/div (X10 magnification) with 5% accuracy. This expansion permits viewing critical rise time or signal shapes with increased resolution. The portion to be expanded is selectable by the DELAY TIME control in main sweep operation. It is then expanded to the sweep speed selected by the delayed TIME/DIV switch after delayed sweep operation is selected. Because the sweeps are independent, the main VERNIER may be out of CAL position while the delayed sweep is still calibrated.

3-79. Sweep jitter can be reduced by use of the delayed operation. By using TRIG mode instead of AUTO in delayed sweep operation, the delayed sweep starts on a new trigger. This reduces the jitter that has accumulated since start of the main sweep.

3-80. LINE SYNC.

3-81. Line sync is selected by depressing both main HF REJ and LF REJ pushbutton. This method of time base synchronization is useful when observing waveforms that are time-related to the line frequency.



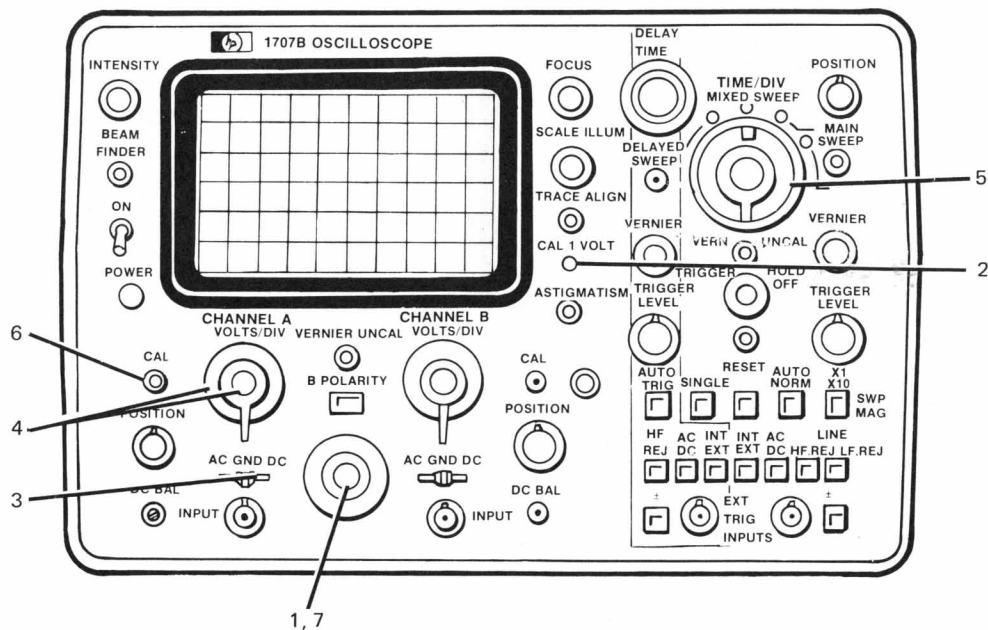
1. Set DISPLAY to A.
2. Set channel A coupling to GND.
3. Set trig to NORM TRIG.
4. Set sweep display to MAIN SWEEP.
5. Set AUTO/NORM to AUTO.
6. Adjust channel A DC BAL for minimum vertical shift while rotating channel vernier between CAL and maximum attenuation.
7. Set DISPLAY to B.
8. Repeat steps 2 through 6 for channel B.

NOTE

If trace is not on CRT, press BEAM FINDER and adjust DC BAL until trace remains on screen

1707B-R-1A

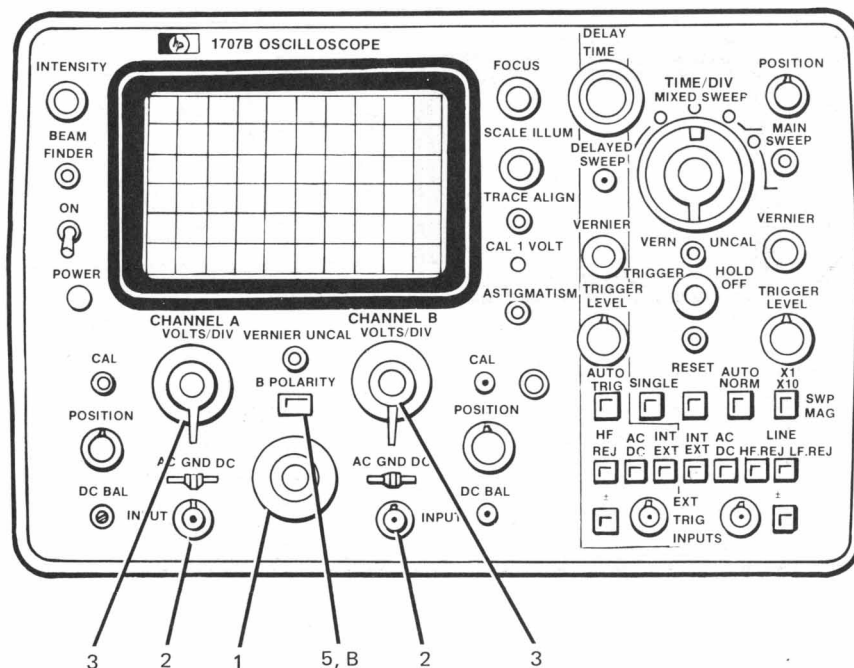
Figure 3-3. DC BAL Adjust



1. Set DISPLAY to A.
2. Connect CAL 1 VOLT output to channel A INPUT, using the Model 10006B 10:1 probe.
3. Set channel A coupling to DC.
4. Set channel A VOLTS/DIV to .02 and vernier to CAL (detent).
5. Set main TIME/DIV to .5 mSEC.
6. Adjust channel A CAL for exactly 5 div of vertical deflection.
7. Set DISPLAY to B.
8. Repeat steps 2 through 6 for channel B.

1707B-R-2A

Figure 3-4. CAL Adjust



ALGEBRAIC ADDITION

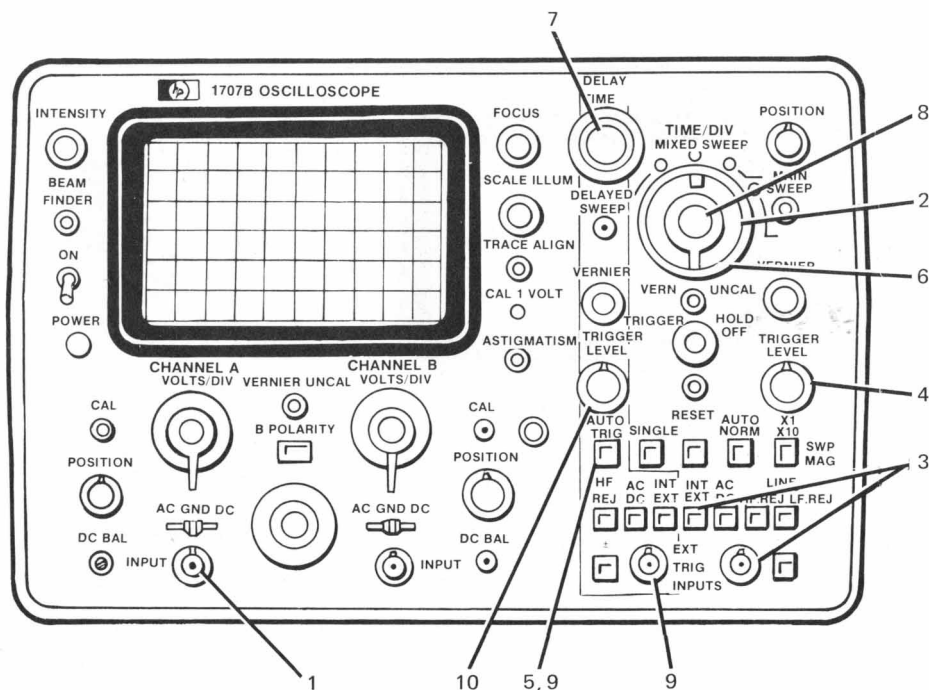
1. Set DISPLAY to A + B.
2. Connect signals to be added to the channel A and B INPUT connectors.
3. Set both VOLTS/DIV and verniers to similar settings.
4. Set time base controls as required to obtain desired display.
5. Set B POLARITY to NORM.
6. The resultant display represents the algebraic sum of channel A and B signals.

DIFFERENTIAL OPERATION

- A. Perform steps 1 through 4 of algebraic addition operation.
- B. Set B POLARITY to INVT.
- C. The resultant display represents the difference between channel A and B signals.

1707B-R-3A

Figure 3-5. Algebraic Addition and Differential Operation



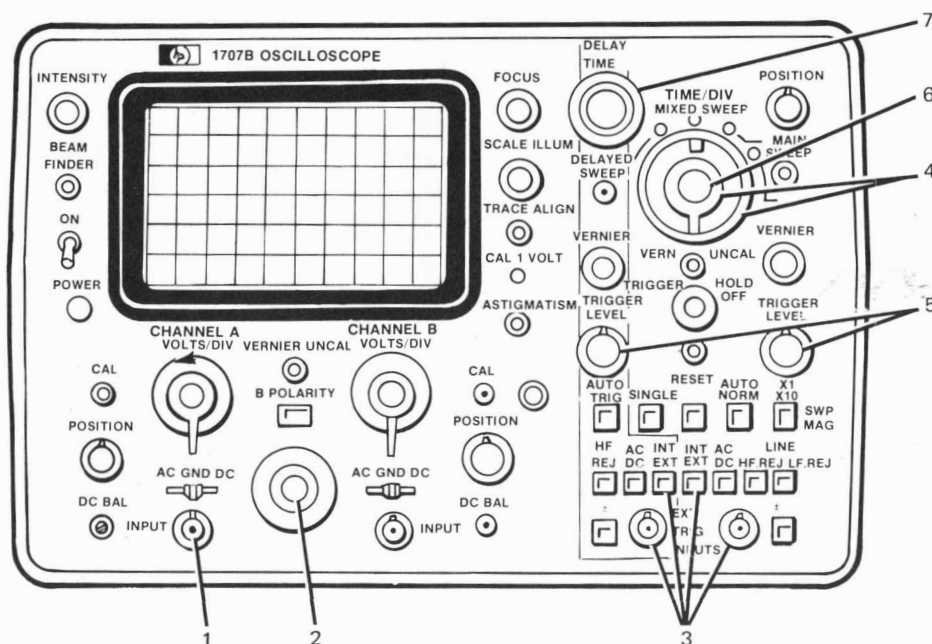
1. Apply signal to channel A INPUT.
2. Set main TIME/DIV to desired sweep speed.
3. Select INT or EXT as desired. If EXT is selected, connect trigger to main EXT TRIG INPUTS.
4. Adjust main TRIGGER LEVEL for stable triggering.
5. Set AUTO/TRIG to AUTO.
6. Set delayed TIME/DIV to desired sweep speed.
7. Adjust DELAY TIME so intensified portion of trace is over area of trace to be investigated.
8. Set sweep display switch to DELAYED SWEEP. Intensified portion of main sweep is now displayed across entire CRT.
9. If jitter is observed on delayed sweep, set AUTO/TRIG to TRIG. This allows the instrument to trigger on the signal of interest and reduces jitter.
10. Adjust delayed TRIGGER LEVEL for a stable display.

NOTE

If EXT triggering is selected, then trigger must be applied to delayed EXT TRIG INPUTS.

1707B-R-4A

Figure 3-6. Delayed Sweep



1. Connect the signal to channel A INPUT.
2. Set trig to A ONLY TRIG or NORM TRIG, as desired.
3. Set main and delayed INT/EXT as desired. If EXT is selected, connect trigger signals to main and delayed EXT TRIG INPUTS.
4. Set main and delayed TIME/DIV to desired sweep speeds.
5. Adjust main and delayed TRIGGER LEVEL for stable triggering.
6. Set sweep display to MIXED SWEEP.
7. Adjust DELAY TIME until desired waveform combination is displayed.

1707B-R-5A

Figure 3-7. Mixed Sweep

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section contains functional descriptions keyed to an overall block diagram of the instrument, and simplified block diagrams of circuit groups. A detailed explanation of circuit functions, keyed to the schematics, is provided after the block diagram discussion. The schematics are located in Section VIII.

4-3. BLOCK DIAGRAM DISCUSSION.

4-4. An overall explanation of circuit operation based on block diagrams (schematics 1 and 2) is presented to generate a basic understanding of the instrument. For simplicity, the block diagrams are drawn for function and do not show all circuit details.

4-5. This instrument consists of a CRT, line rectifier, gate assembly, and three modules. The modules are as follows: (1) vertical amplifier module containing attenuators, vertical preamplifier, delay line, and vertical output amplifier; (2) a horizontal amplifier module containing trigger assembly, horizontal mother board, main and delayed integrators, main and delayed sweep time assemblies, holdoff and comparator assembly, horizontal mode assembly, horizontal preamplifier, and horizontal output amplifier; and (3) power supply module containing low voltage mother board, low voltage converter, low voltage rectifier and filter, high voltage oscillator, and high voltage multiplier.

4-6. INPUT ATTENUATOR. (See schematic 1.)

4-7. The attenuators are compensated voltage-divider types. They provide division ratios of 1, 2, 5, 10, and 100, giving nine separate sensitivities. Each decade, input sensitivity range has an input capacitance adjustment and an attenuator compensation adjustment. Coupling (AC, GND, and DC) is also controlled in the attenuator stages.

4-8. VERTICAL PREAMPLIFIER.

4-9. The vertical preamplifier provides amplification to the input signals for drive to the vertical output amplifier. Channel A sync and composite sync signals originate in the vertical preamplifier. The sync signals are applied to the trigger assembly for internal triggering. Channel switching, chop operation, and display mode are also accomplished in the vertical preamplifier (schematic 7).

4-10. DELAY LINE.

4-11. The delay line provides approximately 160-ns delay to the vertical signal, allowing the horizontal circuits sufficient time to react to the trigger signal so that the event caused by the trigger can be observed on the fastest sweep.

4-12. VERTICAL OUTPUT AMPLIFIER.

4-13. The vertical output amplifier provides drive to the CRT vertical deflection plates.

4-14. TRIGGER CIRCUITS.

4-15. The trigger assembly provides the main and delayed trigger signals to the integrators. Trigger modes are selectable in this assembly. The main trigger circuit provides two outputs to the main integrator (schematic 1). One output is the main trigger that is generated by the trigger gate driver. The output of the trigger gate driver is controlled by the inputs to the gated Schmitt trigger. One input to the gated Schmitt trigger is the trigger signal and the other input is the reset signal from the main integrator. When the reset signal is high, the gated Schmitt trigger is inoperative and no trigger signal is generated. When the reset signal is low, the gated Schmitt trigger is operational and a trigger signal will be generated if there is an internal or external trigger input. The other output is the bright-line auto level which is provided only in the auto mode. The delayed trigger circuit functions identically to the main trigger circuit and provides a trigger signal to the delayed integrator (schematic 12).

4-16. MAIN INTEGRATOR.

4-17. The main integrator initiates a horizontal sweep from the trigger input. When the trigger signal is applied to the gate amplifier, the Miller integrator activates and produces the horizontal sweep ramp. The Miller integrator is connected to the main sweep timing components (schematic 11). The main TIME/DIV switch controls the ramp output from the Miller integrator. The output of the Miller integrator is amplified and applied to the horizontal amplifier circuits.

4-18. The horizontal sweep is also compared to a 12-volt reference by the ramp comparator which drives the main integrator set-reset multivibrator. The set-reset multivibrator, in conjunction with the holdoff and comparator circuit, controls the amplitude and timing sequence of the sweep ramp. When the

sweep ramp reaches +12 volts, the ramp comparator turns on and resets the gated Schmitt trigger to a logic high (1). The signal from the holdoff amplifier determines the holdoff time of the circuits and sets the gated Schmitt trigger to a logic low (0) for a new sweep.

4-19. When the bright-line auto circuit is used, the set-reset multivibrator provides a ground for the bright-line auto level and terminates the sweep. This allows the sweep signal to return to its starting point.

4-20. At the same time that the main ramp is generated, the alt amplifier provides an output to the vertical preamplifier flip-flop for alt operation.

4-21. HOLDOFF AND COMPARATOR.

4-22. The holdoff and comparator establishes the time interval between trigger points. The time interval is adjusted by the TRIGGER HOLDOFF control. A signal from the main integrator set-reset multivibrator activates the holdoff circuit. When the holdoff is activated, a ramp, determined by the holdoff amplifier RC circuits and the TRIGGER HOLDOFF control, is generated. When this ramp reaches a predetermined level, it activates the main integrator set-reset multivibrator. The set-reset multivibrator then sets the trigger set-trigger gates low for a new sweep.

4-23. The main horizontal sweep ramp from the Miller integrator also drives the comparator in the holdoff and comparator assembly. The main sweep is compared to a voltage set by the DELAY TIME dial. When the main sweep is equal to this voltage, the Schmitt trigger sends a pulse to the delayed integrator set-reset multivibrator. This sets the delayed gated Schmitt trigger low and arms the delayed integrator for a new sweep.

4-24. DELAYED INTEGRATOR.

4-25. The delayed integrator operates the same as the main integrator, except for the following differences. This circuit has no bright-line auto input. In the auto mode, a voltage is applied to the input amplifier which activates the Miller integrator for a delayed sweep signal. The Miller integrator is connected to its own RC components for generating the delayed sweep. Sweep limits are set by a comparator and set-reset multivibrator as in the main integrator.

4-26. The set-reset multivibrator has an input from the main integrator set-reset multivibrator. If the main sweep terminates, a voltage from the main integrator is sent to set-reset multivibrator. The multivibrator terminates the delayed sweep and arms the delayed gated Schmitt trigger for a new sweep.

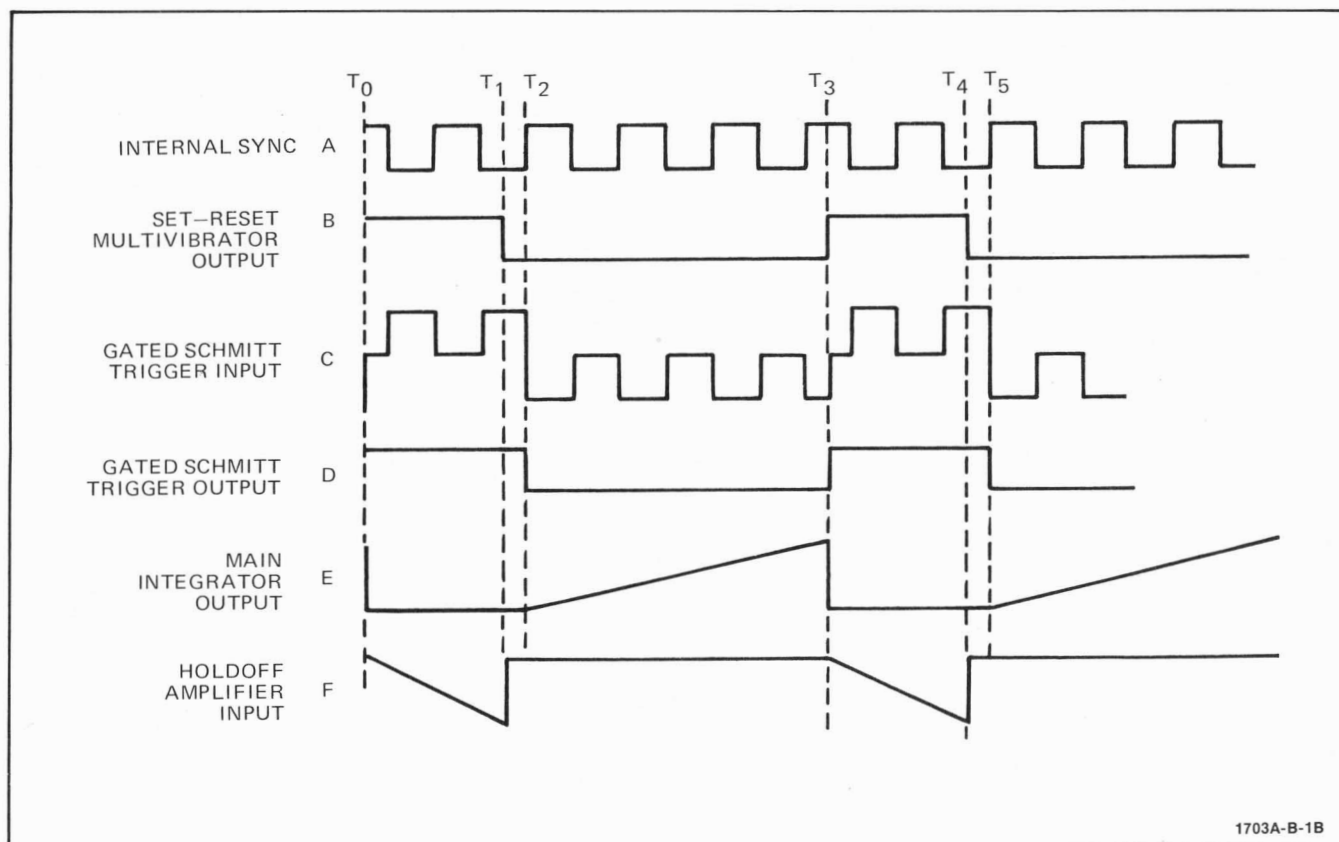


Figure 4-1. Timing Sequence

4-27. TIMING SEQUENCE.

4-28. Figure 4-1 is an illustration representing the time relationship between the trigger and sweep timing circuits. Waveform A represents the input signal to the vertical circuits and the internal sync signal. Waveform B represents the main integrator set-reset multivibrator output. Waveform C represents the input to the gated Schmitt trigger and waveform D represents the output. Waveform E represents the input to the holdoff and amplifier.

4-29. At T_0 , the multivibrator output is high, holding the gated Schmitt trigger high, preventing a sweep signal. At T_1 , the holdoff time is completed and the multivibrator output goes low, activating the gated Schmitt trigger. At T_2 , the trigger signal goes positive and the gated Schmitt trigger output goes low, activating the main integrator which produces a horizontal sweep signal.

4-30. At T_3 , the sweep is terminated and the set-reset multivibrator output goes high. When the set-reset multivibrator goes high, the holdoff time signal starts and the gated Schmitt trigger is locked high, preventing a sweep. At the completion of holdoff time, the sequence is repeated.

4-31. HORIZONTAL MODE ASSEMBLY.

4-32. This assembly controls main sweep, mixed sweep, delayed sweep, external horizontal input and the trace intensity in these modes. A switch selects the type of sweep signal to be displayed.

4-33. The blanking circuit blanks the trace in the main sweep, delayed sweep and mixed sweep modes. The blanking signal is applied to the gate assembly (schematic 2) which controls the high voltage oscillator assembly.

4-34. In the EXT HORIZ INPUT mode, the blanking signal is grounded and the output from the external horizontal amplifier is connected to the horizontal preamplifier. The blanking circuit also intensifies the delayed portion of the sweep in the main sweep and mixed sweep mode. When the delayed TIME/DIV switch is set to some position other than OFF, the main sweep intensity is reduced and the delayed sweep intensity is held at a normal level, providing trace intensification.

4-35. LOW VOLTAGE POWER SUPPLY. (See schematic 2.)

4-36. The low voltage power supply operates from three different power sources. The sources are ac line, internal battery or external dc line. The ac line is applied to the input power module which is selectable for 115- or 230-volt operation and has an ac line protection fuse. The ac input is applied to a step-down power transformer.

4-37. The line rectifier rectifies and filters the power transformer ac output of approximately 36 volts. This voltage is applied to the voltage regulator and a ripple filter which filters out the 120-hertz ripple.

4-38. The voltage regulator output is applied to the low voltage converter. This stage converts the input dc power to usable output dc of different voltage levels. The low voltage converter oscillates between 10 kHz and 45 kHz, depending upon the input voltage and the output power.

4-39. The voltage coupled from the converter to the low voltage rectifier is filtered and applied to the low voltage mother board which provides low voltage distribution to the power supply module. A portion of the +15 and -15 volts is fed back to the low voltage regulator which determines the frequency and duty cycle of the converter for output voltage regulation.

4-40. The filtered voltages from the low voltage mother board are coupled to the gate board. The gate board provides filtering, fuse protection and distribution of the low voltage supplies to the rest of the Model 1707B circuits.

4-41. HIGH VOLTAGE POWER SUPPLY.

4-42. The high voltage power supply consists of the high voltage oscillator, power transformer, rectifying networks, and high voltage multiplier. When the instrument is turned on, the high voltage oscillator activates, coupling voltages from pins 1 and 2 into the secondary pins 6 and 7, 5, 8, and 9. Pins 11 and 10 are connected to filaments of the CRT. The secondary voltage at pin 7 is connected through a rectifying diode to the control grid of the CRT. Pin 8 of the secondary is connected through a rectifying diode to the cathode. A correction voltage is coupled from this diode back through a resistive divider network, controlling the current source. The current source controls the oscillator amplitude and thus the high voltage oscillator output. The CRT voltages are negative, except for the post-accelerator voltage.

4-43. The CRT cathode voltage is fed back to the current source. If the cathode voltage becomes more negative, less current is supplied to the high voltage (hv) oscillator. With less current supplied, the amplitude of the hv oscillator output is reduced and the cathode voltage will return to its normal operating value. If the cathode voltage becomes less negative, more current is supplied to the hv oscillator. The output amplitude now increases and the cathode voltage again returns to its normal operating value. A 6.73 kV peak-to-peak voltage is present at pin 9 of the high voltage transformer. This voltage is applied to the high voltage multiplier circuit where it is multiplied by 3. The 20.2 kV output is applied to the post-accelerator on the CRT.

4-44. GATE AMPLIFIER.

4-45. The gate amplifier has four inputs: one input is from the INTENSITY control, another input is the horizontal mode blanking input, a third input is the vertical preamplifier chop blanking input and the fourth input is from the Z-AXIS INPUT. All of these inputs control the intensity of the Z-axis of the CRT. The output from the gate amplifier to the CRT grid increases or decreases the intensity of the display.

4-46. DETAILED CIRCUIT THEORY.

4-47. The detailed circuit theory is keyed to the schematics located at the rear of this manual. A reference is made to the appropriate schematic at the pertinent point in each discussion. The indicated schematic may then be folded out for reference while reading the text.

4-48. INPUT ATTENUATORS.

4-49. The 75-MHz attenuators (schematic 3) provide selectable attenuation, attenuator compensation, and adjustment of input capacitance. The attenuators are compensated voltage-divider types divided into two cascaded sections. The front section provides division ratios of 1, 10, and 100. The rear section provides division ratios of 1, 2, and 5.

4-50. Because A5A1 (channel A attenuator) and A5A2 (channel B attenuator) are identical, only A5A1 will be discussed.

4-51. A5A1S1 provides a choice of coupling: capacitive (AC), direct (DC), or grounded input (GND). In AC, coupling capacitor A5A1C2 causes low frequency cutoff of approximately 10 Hz.

4-52. Variable capacitors A5A1C8 and A5A1C9 are adjusted to compensate the front section of the attenuator. Range equalization of input capacitance is accomplished by adjusting A5A1C4 and A5A1C5. Rear attenuator compensation is provided by A5A1C18 and A5A1C19. Range equalization of rear section input capacitance is accomplished by adjustment of A5A1C13 and A5A1C14.

4-53. VERTICAL PREAMPLIFIER.

4-54. The vertical preamplifier is diagrammed on schematics 4, 5, 6, and 7. Amplification and control functions are shown on schematics 4, 5, and 6. The display function and trigger selection are shown on schematic 7.

4-55. *Schematic 4.* Separate preamplification for channel A and channel B takes place in the circuits shown on schematic 4. Because the channel A and channel B circuits are nearly identical, only the channel A circuits will be discussed.

4-56. Negative voltage limiter A5A4CR1/A5A4CR2 and positive voltage limiter A5A4CR5/A5A4CR6 are over-voltage protection circuits for A5A4Q1. If the input voltage exceeds approximately 1.2 volts, either A5A4CR1 or A5A4CR5 will conduct and limit the input voltage.

4-57. Field-effect transistors (FET) A5A4Q1 and A5A4Q2 provide the high impedance required to prevent loading of the circuits under test. Amplifier dc balance is also accomplished in this stage. DC BAL adjustment A5R3 permits the dc voltage on the gate of A5A4Q2 to be varied, consequently varying the static dc level at the output of the amplifier.

4-58. Emitter follower stage A5A4Q5/A5A4Q6 provides low impedance drive to the rest of the amplifier.

4-59. Amplification, high frequency compensation, vernier gain control, gain calibration, and dc balance calibration are accomplished in differential amplifier stage A5A4Q9/A5A4Q10. Optimum high frequency response is obtained by adjusting hf adj A5A4C25. Amplifier gain is a function of the resistance between the collectors of A5A4Q9 and A5A4Q10. CAL adjust A5R5 is varied to obtain the precise amount of gain needed in the amplifier. The channel A vernier potentiometer A5R14 permits the gain to be varied between approximately 33% and 100% of the calibrated amplifier gain. chan A dc bal adjust A5A4R43 permits the static dc level of the amplifier to be approximately centered within the range of DC BAL control A5R3.

4-60. Common-base amplifier A5A4Q13/A5A4Q14 provides drive to the channel switches shown on schematic 5.

4-61. Part of the output of A5A4Q5/A5A4Q6 is applied to the channel A sync amplifier shown on schematic 5.

4-62. Channel A vernier switch A5S3 is ganged with channel A vernier potentiometer A5R13. When A5R13 is rotated out of detent, A5S3 closes, applying 100 volts to DS1. Lamp DS1 lights to indicate that the gain control is not in the calibrated position.

4-63. *Schematic 5.* The circuits shown on schematic 5 accomplish channel A and channel B summing, A + B balance, position control, channel B polarity control, and channel A sync signal amplification.

4-64. Summing is accomplished by the channel switches. The channel A switch consists of differential amplifier A5A4Q22/A5A4Q23 and transistor switch A5A4Q20. Whenever A5A4Q20 is turned on (by a voltage from schematic 7), its emitter goes to approximately 6.7 volts, causing A5A4CR10/A5A4CR11 to

turn on. This clamps the emitters of A5A4Q22/A5A4Q23 to approximately +6 volts, turning them off. When A5A4Q20 is turned off, its emitter approaches 0 volt and the diodes turn off. This permits the emitters of A5A4Q22/A5A4Q23 to fall to approximately +4.2 volts, turning the transistors on.

4-65. The channel B switch consists of normal output amplifier A5A4Q25/A5A4Q26, inverted output amplifier A5A4Q24/A5A4Q27, and transistor switch A5A4Q21. Transistor switch A5A4Q21 functions exactly as explained in paragraph 4-64 for A5A4Q20. Depending on the position of B POLARITY switch A5S1, the normal output amplifier or the inverted output amplifier will turn on, but not both. When A5A4Q20 is turned off and A5A4Q21 is turned on, only the channel A signal appears at the output of the channel switches. When A5A4Q20 is turned on and A5A4Q21 is turned off, only the channel B signal appears at the output. When both A5A4Q20 and A5A4Q21 are turned off, the algebraic sum of the channel A and channel B signals appears at the output. If the normal output amplifier is on, the output of the channel switches is the sum of the signals. If the inverted output amplifier is on, the output of the channel switches is the difference between the two signals.

4-66. Feedback amplifier A5A4Q28/A5A4Q29 amplifies the composite signal and drives the delay line driver. The feedback circuits improve frequency response by compensating for collector-to-base capacitance.

4-67. The channel A sync amplifier consists of A5A4Q18, A5A4Q19, and A5A4Q17. Its inputs are from the channel A amplifier on schematic 4 and its output is to the sync selection circuits on schematic 7.

4-68. *Schematic 6.* The vertical preamplifier circuits (A5A4Q32/A5A4Q33) amplify the composite signal and drive the delay line. Amplifier A5A4Q30/A5A4Q31 selects and amplifies the composite sync signal. The composite sync signal drives the sync selection circuits on schematic 7.

4-69. *Schematic 7.* The circuits shown on schematic 7 control the channel switches (schematic 5), generate chop blanking, and select the trigger signal.

4-70. The steering logic circuits control the channel gates and generate chop blanking. Astable multivibrator A5A4Q34/A5A4Q35 is activated when the base of A5A4Q34 is high. It free-runs at approximately 800 kHz. When the base is low, it is prohibited from running. A5A4Q36 controls the channel A gate (schematic 5) and A5A4Q37 controls the channel B gate. A5A4U1 is a four-section integrated circuit (IC) consisting of four NAND gates. Three of the four sections operate conventionally but, because its two inputs are tied together, A5A4U1B functions simply as an inverter. Flip-flop A5A4U2 has two outputs

and three inputs. When C is high and S is low, A5A4U2 acts as an asynchronous flip-flop and the $\bar{Q}$ output is high. When S is high and C is low, A5A4U2 again acts as an asynchronous flip-flop and the Q output is high. When both S and C are low, both $\bar{Q}$ and Q are high. When both S and C are high, A5A4U2 acts as a J-K flip-flop and a negative going transition on T will cause the flip-flop to change states.

4-71. The astable multivibrator is driven by A5A4U1A and A5A4U1B. In all positions of the display switch, except chop, the astable multivibrator is disabled because pin 2 of A5A4U1A is grounded (held low) by the front section of A5S2A. In the chop position, the ground is removed and pin 2 goes high. During sweep time, the alt trigger is high. Because both inputs are now high, the output of pin 3 is low. Pin 6 of A5A4U1B is high and the astable multivibrator is running.

4-72. The clocked flip-flop is driven by A5A4U1C and A5A4U1D. In the A, B and A + B positions of the DISPLAY switch, the T input to the clocked flip-flop is held high because pin 9 of A5A4U1D is grounded (held low) by the rear section of A5S2A. In position A, the S input of A5A4U2 is grounded by the front section of A5S2C and A5A4Q36 is turned on. In position B, the C input is grounded by the rear section of A5S2C and A5A4Q37 is turned on. In position A + B, both S and C are grounded and both A5A4Q36 and A5A4Q37 are turned on.

4-73. In the CHOP and ALT positions of the DISPLAY switch, the S and C inputs of A5A4U2 are ungrounded and go high. Pin 9 of A5A4U1D is also ungrounded and goes high. In these positions, changes at pin 10 of A5A4U1D control the state of the flip-flop.

4-74. In the CHOP position of A5S2, the astable multivibrator is permitted to free-run, its output being routed to pin 12 of A5A4U1C. During the time when the alt trigger is present, the output of the astable multivibrator will cause the clocked flip-flop to change states at each negative transition. The net result being that the channel switches (schematic 5) change between channel A and channel B at a 400-kHz rate.

4-75. In the ALT position of A5S2, the astable multivibrator is again disabled and pin 12 of A5A4U1C is held high. Each negative-going transition of the alt trigger causes the clocked flip-flop to change states. The net result being that the channel switches (schematic 5) alternate, at the sweep rate, between channel A and channel B.

4-76. The chop blanking output of the astable multivibrator is routed via the circuits on schematic 17 to the CRT blanking circuits to blank the CRT during the channel switching transitions.

4-77. The NORMTRIG/A ONLY TRIG switch selects either channel A trigger from schematic 5 or the composite trigger from schematic 6. A5A4Q38 and A5A4Q39 drive the main trigger circuit on schematic 8.

4-78. In the A + B position of the DISPLAY switch, the B section connects +15 volts (schematic 4) to the A + B BAL potentiometer (schematic 5). This permits correction of any dc unbalance caused by turning both the channel A and channel B switches on together.

4-79. DELAY LINE.

4-80. The delay line (schematic 6) provides 160 nanoseconds delay to the vertical signal. This offsets the delay in the trigger and gating circuitry and assures that part of the vertical signal is not lost before these circuits react and start the sweep.

4-81. VERTICAL OUTPUT AMPLIFIER.

4-82. The vertical output amplifier (schematic 6) consists of differential amplifiers A5A5Q1/A5A5Q2 with current source A5A5Q3, feedback amplifier A5A5Q4/A5A5Q5, and cascade differential amplifier A5A5Q6 through A5A5Q9. The amplifier receives the composite signal from the delay line and drives the vertical deflection plates of the CRT.

4-83. Optimum high frequency response is obtained from the amplifier by adjusting hf comp adj A5A5C7, hf peak adj A5A5R30, and hf adj A5A5C12.

4-84. The feedback circuits of A5A5Q4 and A5A5Q5 improve frequency response by compensating for collector-to-base capacitance.

4-85. The BEAM FINDER switch limits the current available to the differential amplifier. This reduces the overall gain and assures that the beam will not be deflected off screen when the BEAM FINDER is pressed.

4-86. TRIGGER CIRCUITS.

4-87. The trigger assembly (schematics 8 and 9) consists of the main and delayed trigger circuits. Inputs are selected from the internal sync circuits in the vertical amplifier, from the main EXT TRIG INPUT, or from the delayed EXT TRIG INPUT. Two outputs, the main trigger signal and the bright line auto signal, are provided to the main integrator. The delayed trigger signal is provided to the delayed integrator.

4-88. *Schematic 8.* The main trigger circuits and the delayed trigger circuits are nearly identical, only the main trigger circuits will be explained.

4-89. The main INT/EXT switch selects a signal from the circuits on schematic 7 or from the main EXT TRIG INPUT.

4-90. The main AC/DC switch connects A6A2C1 in series for capacitive coupling or bypasses it for direct coupling.

4-91. The main LF REJ switch (not used in delayed) bypasses the frequency limiting circuit A6A2C12/A6A2R1 or activates it to reject trigger frequency components below 15 kHz.

4-92. The main HF REJ switch either bypasses the frequency limiting network (A6A2R72/stray capacitance) or connects it to reject trigger frequency components above 30 kHz.

4-93. The main slope switch reverses the inputs to A6A2Q1 and A6A2Q2. This permits triggering on either slope of the trigger waveform.

4-94. The main TRIGGER LEVEL control permits selection of the point on the trigger slope that initiates the sweep. It accomplishes this by shifting the static dc level of the main trigger amplifiers.

4-95. The FET source followers, A6A2Q1/A6A2Q2, provide the high impedance required to prevent loading of the trigger sources.

4-96. The emitter followers, A6A2Q3/A6A2Q4, provide the required low impedance drive to the differential amplifiers.

4-97. The differential amplifiers, A6A2Q5 through A6A2Q8, drive the trigger gate drivers (schematic 9).

4-98. The trigger gate drivers, gated Schmitt triggers, and the trigger outputs for main and delayed are nearly identical so only the main circuits will be discussed. The bright line auto circuit will be explained separately.

4-99. *Schematic 9.* The trigger gate drivers, A6A2Q17 and A6A2Q18 are a differentially driven differential amplifier whose static dc level is closely controlled.

4-100. The gated Schmitt trigger, A6A2U1A and A6A2U1B, consists of two OR circuits with biasing and feedback to cause them to function as a Schmitt trigger. A step-by-step explanation of the gated Schmitt trigger is given in figure 4-2. The gated Schmitt trigger has two functions; to generate a signal to initiate the sweep upon receipt of a trigger, and to prohibit further triggering during sweep and holdoff.

4-101. The threshold voltage for the gated Schmitt trigger is set by the main trigger sensitivity adj A6A2R46.

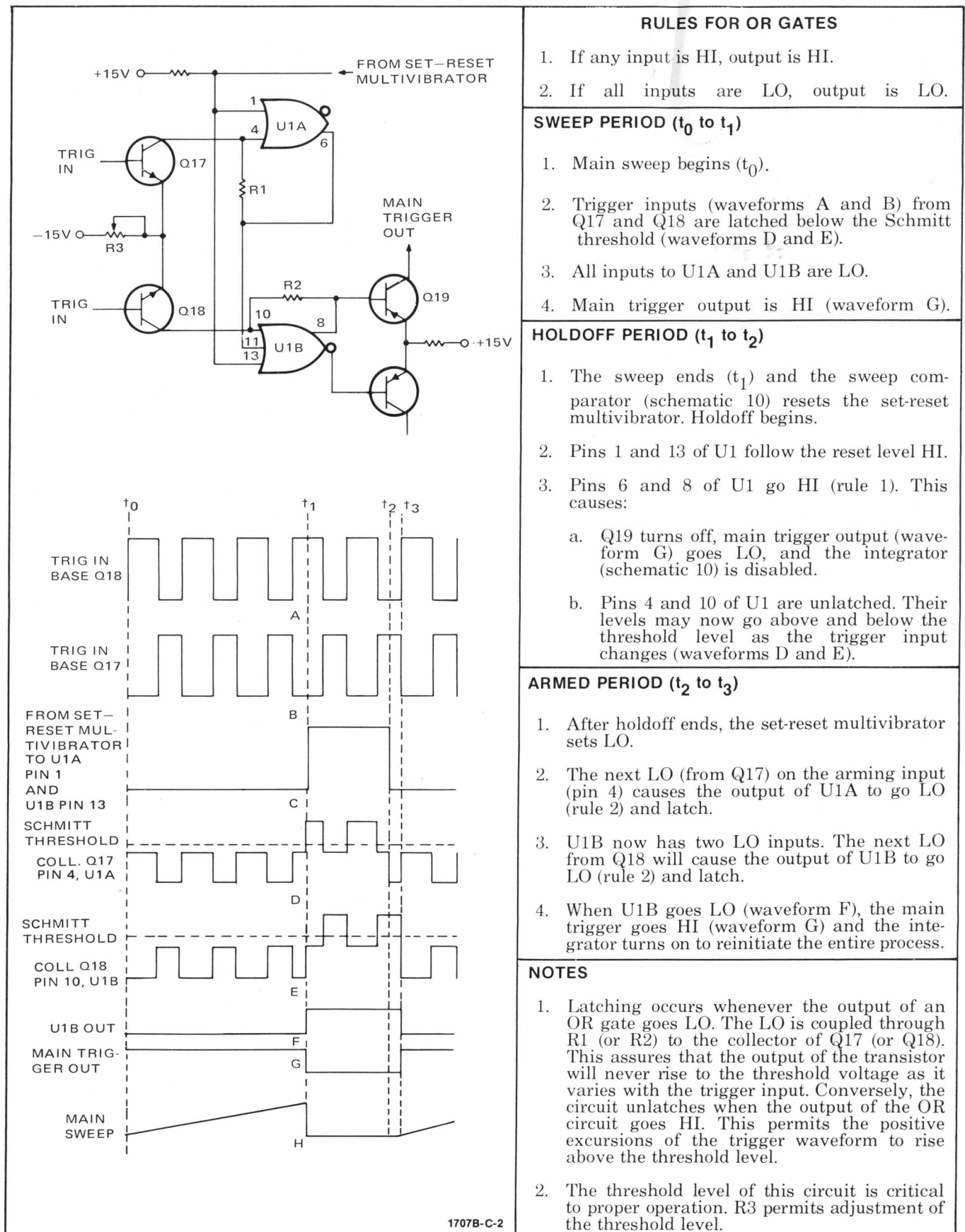


Figure 4-2. Step-by-step Operation of the Gate Schmitt Trigger

4-102. The trigger output, A6A2Q19/A6A2Q20, functions exactly like the trigger gate driver (paragraph 4-99).

4-103. When pin 8 of A6A2U1B goes low and A6A2Q19 turns on, pin 9 goes high and A6A2Q20 turns off. A6A2Q21 turns on and saturates. If no further trigger signals are applied, the collector voltage of A6A2Q21 decays through an RC network consisting of A6A2R54, A6A2C11, and A6A2R55. When the voltage decays to approximately -16 volts, A6A2CR12 turns on. A6A2Q23 and A6A2Q24 turn on and Schmitt trigger A6A2Q25/A6A2Q26 activates, supplying current to the main integrator gate (schematic 10) through A6A2R60. In this manner, the sweep is initiated in the absence of trigger pulses.

4-104. MAIN INTEGRATOR.

4-105. The main integrator assembly consists of the main integrator and associated circuits (schematic 10), the set-reset multivibrator (schematic 10), and the main sweep time assembly (schematic 11). The main integrator in conjunction with the main sweep time assembly generates the main sweep ramp, provides main blanking to the horizontal mode assembly (schematic 15), and alternate triggering to the vertical preamplifier (schematic 7). The set-reset multivibrator terminates the main sweep, terminates the delayed sweep if the main sweep terminates, and sets the gated Schmitt trigger (schematic 9) low to arm for a new trigger.

4-106. *Schematic 10.* Gate amplifier A6A3Q1, in the absence of a main trigger, is turned off. A positive pulse on either of its two inputs, main trigger or bright line auto, turns it on. When A6A3Q1 turns on, its collector approaches 0 volt and A6A3CR5, A6A3CR6, and A6A3CR9 turn on. This initiates main blanking, alternate trigger, and main sweep.

4-107. When A6A3CR5 turns on, it furnishes a ground to the horizontal mode blanking circuit (schematic 15). This turns the CRT on and allows the trace to be seen. When A6A3Q1 is off, the blanking circuit is on, blanking the CRT.

4-108. When A6A3CR9 turns on, it causes A6A3CR13 and ramp control A6A3Q6 to turn off, activating the integrator.

4-109. The Miller integrator consists of the components associated with A6A3Q7/A6A3Q8 (schematic 10) and, according to the position of the main TIME/DIV switch, certain of the main sweep time assembly components (schematic 11). Basically, the function of the main TIME/DIV switch is to connect a selected integrating capacitor between the collector of A6A3Q8 and the gate of A6A3Q7. The switch also connects an integrating resistor between the gate of A6A3Q7 and a calibrated charging voltage. During holdoff and

armed time, A6A3Q6 is turned on, clamping the gate of A6A3Q7 to a fixed voltage. When A6A3Q6 turns off, a charging current through the integrating resistor causes the integrating capacitor to start charging (negatively). This change is integrated and appears at the output of A6A3Q8 as a linear positive-going ramp. Output amplifier A6A3Q9 drives the horizontal circuits (schematic 16 via schematic 15). The ramp also drives the comparator.

4-110. During holdoff and armed time, A6A3CR12 is turned on, clamping the emitter of A6A3Q5, holding the transistor on, and setting the baseline of the ramp. When A6A3CR12 turns off, the emitter of A6A3Q5 is permitted to follow its base. As the ramp (from A6A3Q8) rises on the base of A6A3Q5, the emitter follows. When the ramp voltage equals the voltage on the base of A6A3Q2 (approximately +12 volts), the comparator changes states. This establishes the magnitude of the ramp. The resultant current through A6A3R6 causes common-emitter amplifier A6A3Q3 to turn on.

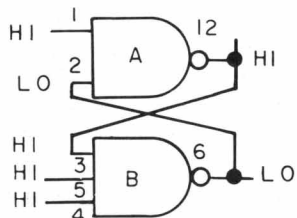
4-111. The set-reset multivibrator (A6A3U1) is an R-S flip-flop composed of two negated output AND (NAND) gates. A step-by-step explanation of the operation of the set-reset multivibrator is shown in figure 4-3. This circuit has several functions. First, it permits the formation of a main trigger any time a trigger pulse arrives during armed periods. It does this by providing a low (from its pin 6 output) to pin 1 of the set-trigger Schmitt (schematic 9). Secondly, it terminates the delayed ramp any time the main ramp terminates before the completion of the delayed ramp. It does this in the following manner; when pin 6 of the set-reset multivibrator (schematic 10) goes high at the end of the main sweep, the high is inverted by A6A3U1C and applied (as a low) to pin 4 of the delayed set-reset multivibrator (schematic 12), setting it and terminating the delayed sweep. Third, it initiates holdoff. It does this by changing states at the end of sweep time and presenting a high (from pin 6) to turn on A6A7Q1 and A6A7Q4 (schematic 14). Fourth, the set-reset multivibrator prevents the formation of a new main trigger during holdoff. It does this by presenting the high on pin 6 to pin 1 of the set-trigger schmitt (schematic 9), disabling it. Finally, it terminates the main sweep during operation of bright line auto. It does this as follows: when pin 6 goes high at the end of sweep time, pin 12 goes low. This turns A6A3CR3 on, grounding the bright line auto signal and turning A6A3Q1 off.

4-112. The AUTO/NORM switch grounds the bright line auto input, preventing this circuit from initiating a sweep.

4-113. The SINGLE switch disconnects the main enable line. In this condition, the last sweep cycle proceeds to condition 3 (figure 4-3) but, because the main enable line is disconnected, cannot proceed

RULES FOR NAND GATES

1. If any input is LO, output is HI.
2. If all inputs are HI, output is LO.

**INITIAL (SET) CONDITION**

(armed and sweep periods)

A6A7Q7 (schematic 14) is turned off and pin 1 is HI.

A6A3Q3 (schematic 10) is turned off and pin 5 is HI.

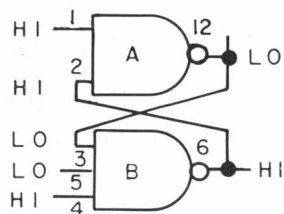
Pin 4 is not connected and is always HI. Flip-flop is in SET condition so pin 12 is HI and pin 6 is LO.

Pin 3 is HI because it is connected to pin 12.

Pin 2 is LO because it is connected to pin 6.

Gate A complies with rule 1.

Gate B complies with rule 2.

**CONDITION 2**

(end of sweep)

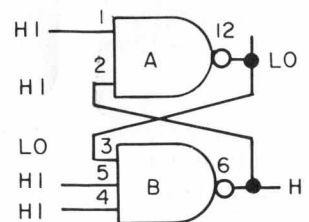
A6A3Q3 (schematic 10) turns on and pin 5 goes LO.

Gate B complies with rule 1 so pin 6 goes HI and pin 2 follows.

Gate A now complies with rule 2 so pin 12 goes LO.

Flip-flop is in RESET condition.

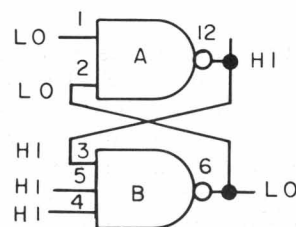
Holdoff time starts

**CONDITION 3**

When sweep retrace starts A6A3Q3 turns off and pin 5 goes HI.

Gate B still complies with rule 1 so flip-flop does not change states.

Flip-flop is armed for change on pin 1.

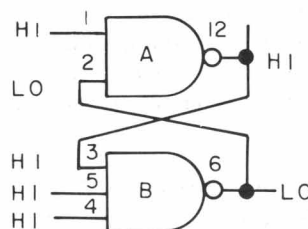
**CONDITION 4**

At end of holdoff, A6A7Q7 turns on and pin 1 goes LO.

Gate A now complies with rule 1 so pin 12 goes HI and pin 3 follows.

Gate B now complies with rule 2 so pin 6 goes LO and pin 2 follows.

Flip-flop is again in SET condition.

**CONDITION 5**

A6A7Q7 turns off, permitting pin 1 to go HI. Gate A still complies with rule 1 so flip-flop does not change states.

Flip-flop is still in initial (SET) condition and is now armed for change on pin 5.

1707B-A-17

Figure 4-3. Step-by-step Operation of the Set-reset Multivibrator

further. The reset switch connects A6A1C1 and, during the initial surge of its charging curve, pin 1 of A6A3U1 is drawn low and the flip-flop goes to condition 4 (figure 4-3).

4-114. Lamp driver A6A1Q1 turns off whenever the main reset and holdoff line goes low, causing the RESET lamp (DS2) to light.

4-115. *Schematic 11.* The main sweep time assembly, A6A5, provides selection of an integrating resistor, an integrating capacitor, and a calibrated charging voltage for the main integrator (schematic 10).

4-116. Section A of the main TIME/DIV switch, A6A5S1, selects the integrating resistors for all sweep speeds, except the five fastest speeds. The resistors for the five fastest speeds are selected by section B.

4-117. A separate capacitor is provided for each two decades of the main TIME/DIV switch. The B and C sections of the switch select all except the five fastest positions. The integrating capacitor (A6A3C8) for the five fastest positions is permanently wired into the main integrator circuitry (schematic 10). On all other positions, A6A3C8 is in parallel with the selected capacitor.

4-118. Operational amplifier A6A5Q1, A6A5Q2, and A6A5Q3 provides a fixed charging voltage at the collector of A6A5Q2. The charging voltage is separately calibrated for each two decades of the main TIME/DIV switch. The D section of the switch selects the calibrating potentiometers.

4-119. HOLDOFF AND COMPARATOR.

4-120. The circuits on the holdoff and comparator assembly (schematic 14) have two functions: to determine the time between the end of one sweep and the arming of the next (holdoff), and to determine the time between the beginning of the main sweep and the beginning or arming of the delayed sweep (delay).

4-121. During sweep time, A6A7Q1 is turned off and A6A7Q4 is turned on. The capacitor selected by TIME/DIV switch A6A7S1 is charged to about +16 volts. When the main set and reset voltage (from schematic 10) goes high at the end of sweep time, A6A7Q1 turns on and A6A7Q4 turns off. The selected capacitor starts discharging exponentially through A6A7R13 and TRIGGER HOLDOFF potentiometer A6R7. The rate of discharge (and holdoff time) is determined by the setting of A6R7. When the charge on the selected capacitor has fallen to approximately 0 volt, A6A7Q7 turns on. A6A7CR6 turns on and applies a low to the set-reset multivibrator (schematic 10), enabling it. When the main reset and holdoff voltage goes low, A6A7Q1 turns off and A6A7Q4

turns on. As the charge on the selected capacitor starts to rise, A6A7Q7 turns off. The capacitor quickly rises to +16 volts.

4-122. Whenever the voltage on the base of A6A7Q2 is less positive than the voltage on the base of A6A7Q3, A6A7Q2 is turned on and A6A7Q3 is turned off. The voltage on the base of A6A7Q3 (and delay time) is selected by DELAY TIME potentiometer A6R3. When the main ramp rises to equal the selected voltage on the base of A6A7Q3, the ramp comparator changes states; A6A7Q2 turns off and A6A7Q3 turns on. The resultant current through A6A7R7 causes A6A7Q6 to turn on. At the end of main sweep time, the circuit returns to the original state. The net result is a low at the collector of A6A7Q6 between that point on the main ramp selected by the DELAY TIME potentiometer and the end of the main ramp. At all other times, the collector of A6A7Q6 is high.

4-123. The Schmitt trigger (U1) consists of an R-S flip-flop formed by two NAND gates and a third NAND gate connected to function as an inverter. When A6A7Q6 turns on, its collector goes low and the Schmitt trigger changes states. The output transition is summed and differentiated by A6A7C9 and A6A7R15. The resultant negative-going pulse enables the set-reset multivibrator (schematic 12). The net result is that the delayed sweep is enabled at a time (relative to the main sweep) selected by the DELAY TIME potentiometer.

4-124. DELAYED INTEGRATOR.

4-125. The operation of the delayed integrator (schematics 12 and 13) is nearly identical to the operation of the main integrator (paragraph 4-104). Only the exceptions will be discussed.

4-126. *Schematic 12.* The set-reset multivibrator is enabled by the delay enable voltage from schematic 14. Because the delay enable voltage does not occur until that time selected by the DELAY TIME control, the delayed sweep cannot start (AUTO/TRIG set to TRIG) until arrival of the first trigger pulse after the selected time.

4-127. When the AUTO/TRIG switch is set to AUTO, the delayed sweep starts immediately after delay enable. The AUTO enabling voltage is grounded through A6A4CR3 by a low on pin 12 of A6A4U1A. When the delay enabling voltage causes the set-reset multivibrator to change states, pin 12 goes high. This causes A6A4CR3 to turn off and the AUTO enabling voltage turns A6A4CR1, A6A4CR2, and A6A4Q1 on, initiating the delayed sweep.

4-128. The output of A6A4U1C is not used.

4-129. *Schematic 13.* An OFF position has been added to the delayed TIME/DIV switch to disable the delay function. When the delayed TIME/DIV

switch is set to OFF, a ground is applied to the Schmitt trigger (schematic 14) to disable it. The ground is also used to disable the trace intensification (schematic 15).

4-130. HORIZONTAL MODE.

4-131. The horizontal mode assembly (schematic 15) has two functions: sweep selection and blanking. Both functions are controlled by sweep display switch A6A8S1.

4-132. *Sweep Selection.* Section 1F of A6A8S1 selects either the output of the main integrator (MAIN SWEEP), the output of the delayed integrator (DELAYED SWEEP), the output of both (MIXED SWEEP), or EXT HORIZ INPUT. The selected output drives the horizontal amplifier (schematic 16).

4-133. *Blanking.* The blanking circuit provides blanking current to gate assembly A4 (schematic 17). Maximum current in the blanking output completely blanks the CRT. No current output causes maximum brightness of the CRT display.

4-134. Figure 4-4 is a simplified schematic showing part of the circuitry on schematic 15 and part of the circuitry on schematic 17. Current source 1 is controlled by three blanking gates and one switch. The main blanking gate comes from transistor switch A6A3Q1 on schematic 10. The delayed blanking gate comes from transistor switch A6A4Q1 on schematic 12. The mixed blanking gate comes from transistor switch A6A8Q2 on schematic 15. Each gate goes low at the appropriate time and grounds the diode(s) to which it is connected.

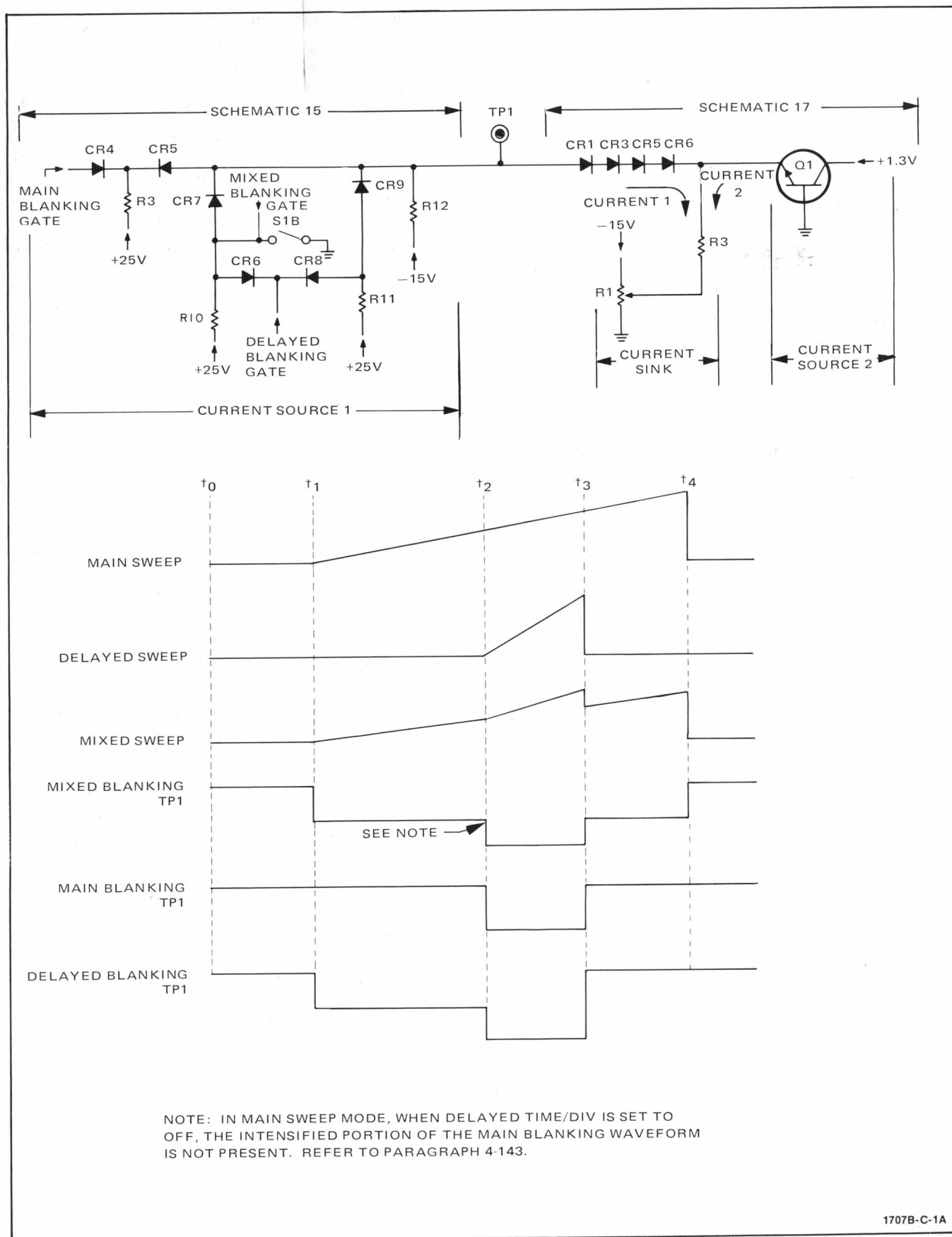
4-135. The current sink draws current from two sources: current source 1 and current source 2. The impedance of current source 2 is constant. The impedance of current source 1 varies according to the number of resistors (R3, R10, and R11) switched in at any given time. When the impedance of current source 1 decreases, more current is drawn from current source 1 and less current is drawn from current source 2. This causes the CRT to be less bright. When the impedance of current source 1 increases, less current is drawn from current source 1 and more from current source 2. This causes the CRT to turn on brighter.

4-136. *Main Sweep Mode.* In main sweep mode, section B of sweep display S1B grounds CR7. CR7, being grounded, is off so that R10 does not supply blanking current during any part of main sweep operation. At time t_0 , both main and delayed blanking gates are off. CR5 and CR9 are on and R3 and R11 are supplying current to the blanking output. This causes the current in current source 2 to decrease and the CRT is blanked. At time

t_1 , the main blanking gate closes and grounds CR4. CR4, being grounded, turns on, causing CR5 to turn off. At this time, only R11 is supplying blanking current; current source 2 supplies more current and the CRT turns on. At time t_2 , the delayed blanking gate closes. CR8, being grounded, turns on, causing CR9 to turn off. At this time, current source 1 is supplying no current. Current source 2 is supplying maximum current and the CRT is at maximum brightness (intensified). At time t_3 , the delayed sweep terminates and the delayed blanking gate turns off. CR9 turns back on and R11 supplies blanking current. This causes the brightness of the CRT to be reduced (not intensified). At time t_4 , the main sweep terminates and the main blanking gate turns off. CR5 turns on and R3 current augments the blanking current from R11 and causes the CRT to turn off (blanked). The next time the main sweep starts, the entire process will repeat.

4-137. *Mixed Sweep Mode.* At the start of the mixed sweep cycle, the mixed blanking gate (figure 4-4) is closed and CR7 is turned off. Both main and delayed blanking gates are off, permitting R3 and R11 to supply current and blank the CRT as in main mode. At time t_1 , the main blanking gate closes, CR4 turns on, CR5 turns off, and again, only R11 supplies current, permitting the CRT to turn on. At time t_2 , the delayed blanking gate closes. At this time the mixed blanking gate opens but, because the delayed blanking gate is closed, R10 is still unable to supply current. When the delayed blanking gate closes, CR8 turns on and CR9 turns off. Current source 1 supplies no current to the current sink while current source 2 supplies maximum current. Under this condition, the CRT is at maximum brightness (intensified). At time t_3 , the delayed blanking gate turns off. CR6 and CR8 turn off, CR7 and CR9 turn on, and both R10 and R11 supply current to the current sink. The combined currents are enough to blank the CRT. The events between t_3 and t_4 continue to take place but are not seen because the CRT is blanked. At time t_4 , the main blanking gate opens and the mixed blanking gate closes. R10 ceases to supply current but R3 starts supplying current; the net result being that the CRT continues to be blanked. At the start of the next main sweep, the entire process will repeat.

4-138. *Delayed Sweep Mode.* In the delayed sweep mode, the mixed blanking gate (figure 4-4) is open during the entire cycle. At the start (t_0) of the process, the main and delayed blanking gates are open and current is supplied from R3, R10 and R11. At time t_1 , the main blanking closes. CR4 turns on, CR5 turns off, and R3 ceases to supply current. Because the delayed and mixed blanking



1707B-C-1A

Figure 4-4. Blanking Sequence

gates are both off at this time, the CRT remains blanked. At time t_2 , the delayed blanking gate closes. CR6 and CR8 turn on, CR7 and CR9 turn off, and R10 and R11 cease supplying current. Because current source 1 is supplying no current, the CRT turns on to maximum brightness. Although intensification is not needed in delayed sweep mode, maximum brightness usually is needed because the delayed sweep is at a much faster rate than the main sweep. At time t_3 , the delayed blanking gate turns off. CR6 and CR8 turn off, CR7 and CR9 turn on, and both R10 and R11 supply current to blank the CRT. The events between t_3 and t_4 continue to take place but, because the CRT is turned off, are not seen. At t_4 , the main blanking gate opens. The next main sweep will reinitiate the entire cycle.

4-139. Mixed Sweep Blanking Circuit. The mixed sweep blanking circuit (schematic 15) consists of emitter follower A6A8Q1, enabling gate A6A8U1A, R-S flip-flop A6A8U1B/A6A8U1C, and transistor switch A6A8Q2. The purpose of the circuit is to turn A6A8Q2 on and off (mixed blanking gate in figure 4-4) at the proper time.

4-140. In main sweep, the mixed sweep blanking circuit is held in a position that permanently turns A6A8CR7 off by the closed contacts of the SWEEP DISPLAY switch.

4-141. In the mixed sweep mode, A6A8Q2 is initially turned on. When the main sweep starts, the emitter of A6A8Q1 goes low and the enabling gate enables the R-S flip-flop. When the delayed sweep starts, delayed blanking goes low and the negative-going, leading-edge transition is differentiated by A6A8C3 and A6A8R9. The resulting pulse causes the flip-flop to change states and A6A8Q2 turns off. When the main sweep terminates, the positive-going transition of the main blanking signal resets the R-S flip-flop in preparation for the next cycle.

4-142. Resistor A6A8R12 is connected to the -15-volt power supply and supplies additional current to speed up switching.

4-143. Delayed Sweep Off. In main sweep mode, (schematic 15) the operator has the option of having the main sweep intensified during the time the delayed sweep is in progress, or of disabling this feature. When the delayed sweep is set to OFF, A6A8CR10 is grounded. This permanently turns A6A8CR9 off while in this mode of operation. Because the closed contacts of the sweep display switch cause A6A8CR7 to be off at all times in main sweep mode, A6A8R3 is the only source of blanking current in main sweep with delayed sweep set to OFF. The values of A6A8R3, A6A8R10, and A6A8R11

are selected to cause the correct CRT illumination in the various modes. Current from A6A8R3 alone is sufficient to blank the CRT.

4-144. External Horizontal Amplifier. The amplifier (schematic 15) consists of three cascaded differential amplifiers, a controlled current source and a single-ended emitter follower output stage. The input of the first stage, FET differential amplifier A8Q1/Q2, is driven single-ended from the output of a compensated voltage divider consisting of A8R1, A8C1/A8R2 and A8C2. The input circuit provides the required high impedance and voltage step-down. Voltage clamp A8CR1 and A8CR2 limits the voltage on the gate of A8Q1 between +15 volts and -15 volts.

4-145. Differential amplifiers A8Q3/A8Q4 and A8Q5/A8Q6 are driven differentially from the output of A8Q1/A8Q2. The differential drive removes common mode noise from the signal waveforms and increases the amplifier bandpass.

4-146. Controlled current source A8U1 provides temperature compensation for the amplifier by maintaining equal currents into the two inputs. Normally, a change of current in A8Q6 will cause an opposite change in current in A8Q5 which, in turn, causes a change in the output voltage. When the current into A8U1 pin 1 changes, the current into A8U1 pin 8 changes an equal amount and direction by action of the controlled current source. This change opposes the change in A8Q5 and thus provides compensation.

4-147. A8Q5 drives emitter follower A8Q7 which provides the required single-ended low impedance output. Amplifier gain is adjusted by varying horiz gain adj A8R15. A 10-to-1 gain ratio is provided by ext horiz VERNIER R6.

4-148. GATE ASSEMBLY.

4-149. The gate assembly (schematic 17) combines (sums) inputs from five different sources and controls the brightness of the CRT. The basic input is the current sink consisting of A4R3, INTENSITY potentiometer R1, and the -15-volt power supply. The current sink draws current from one or more sources. The basic source is A4Q1. The amount of current drawn from A4Q1 depends on the setting of the INTENSITY potentiometer. The amount of current drawn from A4Q1, in turn, controls the brightness of the CRT.

4-150. When the BEAM FINDER switch is pressed, A4CR8 and A4R1 are connected in parallel with the current sink, causing it to demand more current. This causes the CRT to turn on with maximum intensity.

4-151. When the Z AXIS INPUT is connected to a voltage source, A4R2 and the voltage are in parallel

with the current sink, causing it to demand more or less current according to the potential at the Z AXIS INPUT.

4-152. The sweep blanking input (from schematic 15) functions as another current source. Because the current sink, at a given INTENSITY setting, draws a fixed amount of current, varying the current in one current source will cause the current in another source to vary. If the sweep blanking input supplies more current, A4Q1 will supply less. Conversely, if the sweep blanking input supplies less current, A4Q1 will supply more.

4-153. The chop blanking input (from schematic 7) is also a current source. The chop blanking input supplies either enough current to cause CRT blanking or none.

4-154. Transistor A4Q1 draws current from the bases of A4Q3 and A4Q4. A4Q3 drives A4Q7 and A4Q4 drives A4Q8. A4Q7 and A4Q8 are connected in the complementary configuration in order to provide the required dynamic range to drive the intensity control grid of the CRT between cutoff and saturation.

4-155. The feedback circuit, consisting of GATE RESPONSE ADJ A4C7 and A4R18, is adjusted to optimize the frequency response of the amplifier.

4-156. CALIBRATOR.

4-157. The calibrator consists of emitter-coupled multivibrator A4Q2/A4Q5, output amplifier A4Q6, and avalanche diode A4VR1. The multivibrator free-runs at approximately 1 kHz, turning A4Q6 on and off with each cycle. A4VR1 causes a 6.2-volt square wave at the collector of A4Q6 as it turns on and off. The cal amp adj potentiometer A4R29 is adjusted to cause a 1-volt division of the square wave at the CAL 1 VOLT output.

4-158. HORIZONTAL PREAMPLIFIER AND OUTPUT ASSEMBLIES.

4-159. The horizontal preamplifier assembly (schematic 16) amplifies the sweep signal and controls the horizontal position of the trace. It also provides sweep length adjustment, trace magnification (X10), and trace centering. The horizontal output amplifier (schematic 16) provides class B drive to the horizontal plates of the CRT.

4-160. The sweep signal is applied to the input of A6A9Q1. A6A9Q1 is balanced by temperature compensated amplifier A6A9Q2. Differential amplifier A6A9Q3/A6A9Q4 provides differential drive to the horizontal output amplifier. When the SWP MAG switch is set to X10, the gain of the differential amplifier is increased by a factor of approximately 10. X10 gain potentiometer A6A9R21 is adjusted

to set the gain increase to exactly 10. MAG ADJ A6A9R2 is used to center the X10 display. When the BEAM FINDER switch is pressed, less current is supplied to the differential amplifier, reducing its gain and assuring that the beam is not deflected off screen.

4-161. The output stage of the horizontal output amplifier is a class B differential amplifier. Each side consists of a pair of transistors connected in the complementary configuration. Each output transistor has a separate driver. Feedback circuits on both sides improve the linearity of the amplifier.

4-162. INDICATOR DRIVERS.

4-163. The low battery indicator driver A4Q9 (schematic 19) is normally turned off. When the battery output drops below a predetermined level (approximately 22.5V), A4Q9 turns on, and A4CR11 turns off. A4R24, A4C11, and DS1 become a relaxation oscillator, causing DS1 to flash.

4-164. Scale lamp driver A4Q10 (schematic 19) is a linear amplifier that drives the scale illumination lamps, A7DS1 and A7DS2. The brightness of the lamps is dependent on the setting of SCALE ILLUM potentiometer R3.

4-165. LOW VOLTAGE POWER SUPPLY.

4-166. Model 1707B can be operated from a 115-volt ac line, a 230-volt ac line, an 11.5-volt to 36-volt dc line, or from a self-contained battery. Circuits and controls for converting these inputs to the required dc voltages are shown on schematics 19, 20, and 21.

4-167. *Schematic 19.* Schematic 19 diagrams the POWER MODE switch S2 and the circuitry for operating from an ac power line. Power module assembly A1 contains the ac line input fuse A1F1 and the 115/230 input selection switch A1S1. The ac input is applied to the primary of power transformer T1, a 4:1 stepdown transformer. Z1 provides full-wave rectification for the line voltage. A2C1 and A2C2 are ripple filter capacitors. A2R1 and A2CR1 provide a 40-mA trickle charge to battery BT1 in ac line operation when the POWER switch is ON. A3Q2 and A3A1Q1 function as a coarse series regulator. At line input voltages above approximately 115 volts, current through A3A1R1 and A3A1VR1 establish a fixed voltage for the base of A3A1Q1. This limits the voltage output of A3Q2 to approximately 33 volts. A3A1VR4 provides a high dynamic impedance to the power supply ripple voltage. A3A1CR1 is a protective diode for A3Q2 and A3A1Q1. When the ac line cord is plugged in and the POWER switch is set to the off position, a 400-mA charging current is passed through A3A1R5 and A3A1CR2 to the battery. When the battery is in a discharged condition, it tends to draw too much current from the

power supply. This could damage both the power supply and the battery. When this happens, the voltage drop across A3A1R5 will cause A3A1VR2 to fire and rob current from the base of A3A1Q1. This reduces the current to the base of A3Q2 and lowers the output voltage and the battery charging current. The POWER MODE switch S2 selects the output from the ac power supply, the DC LINE J2, or the battery BT1. Fuse F1 remains in the circuit in all three power modes.

4-168. *Schematic 20.* This schematic shows the low voltage converter protection circuits, the low voltage converter assembly, and the low voltage regulator. The protection circuit protects the instrument in case of regulator failure, inadvertent application of more than 40 volts on the dc line, inadvertent reversal of the dc line polarity, or overvoltage (>15V) from the low voltage converter. The low voltage converter assembly, regulated by the low voltage regulator, converts the dc input to a regulated, pulsating dc to operate the low voltage transformer (schematic 21).

4-169. If a dc voltage is inadvertently connected with the wrong polarity, A3A1CR3 conducts, causing the line fuse (F1 on schematic 19) to open. If a dc voltage over 40 volts is connected, A3A1VR3 conducts, causing A3A1SCR1 to conduct and the line fuse opens. If the regulated +15-volt supply (schematic 21) goes above approximately 20 volts, thyristor A3A1CR5 conducts. The RC time constant of A3A1R19 and A3A1C2 causes a delay in the conduction of A3A1CR5 to prevent it from being turned on by transients. When A3A1CR5 conducts, it induces a pulse through A3A1T1 into the gate of A3A1SCR1 causing it to conduct and open the line fuse.

4-170. When the instrument is first turned on, A3A2Q1 and A3A2Q2 are both turned off. Current through A3A2R2 and A3A2VR2 establishes the operating potentials for A3A2Q1. Capacitor A3A2C7 starts charging through A3A2R6. When the voltage across A3A2C7 reaches the peak-point emitter voltage of unijunction transistor A3A2Q1, the transistor turns on, causing A3A2Q2 to turn on. When A3A2Q2 turns on, A3A2Q1 turns off and does not turn on again, unless the instrument is turned off, because A3A2CR5 keeps A3A2C7 discharged below the peak-point emitter voltage of A3A2Q1.

4-171. The low voltage converter is regulated by varying the amplitude of a dc current in the tertiary winding (pins 5 and 6) of A3A2T1. This varies the permeance of the core and, in turn, varies the duty cycle of the converter, thus controlling the output voltage. The -15-volt power supply output (schematic 21) is applied to A3A2R1 and A3A2VR1 (schematic 20) to establish a reference voltage. A sample of the output of the +15-volt supply (through A3A2R3 and A3A2R4) is compared with the reference voltage. Any difference voltage is amplified and inverted by

operational amplifier A3A2U1. The output of A3A2U1 drives the inputs of complementary amplifier A3A2Q3/A3A2Q4 whose current path is through the tertiary winding of A3A2T1. In this manner, a change in the output of the +15-volt supply causes a change in the current through the tertiary winding. The change will be in such a direction as to correct the original change in the output of the power supply.

4-172. *Schematic 21.* When the flyback voltage is induced into the secondaries of A3A3T1, the voltage is rectified and filtered by the diodes, inductors and capacitors on low voltage rectifier and filter assembly A3A3. The outputs are connected to low voltage mother board A3A1 where further filtering takes place. The low voltage power supply control voltages and the high voltage power supply operating voltages are connected to circuits on schematics 20 and 18 respectively. The remainder of the outputs are connected to components on gate assembly A4 where fusing, further filtering and distribution are accomplished.

4-173. HIGH VOLTAGE POWER SUPPLY.

4-174. The high voltage power supply (schematic 18) generates the high voltage operating potentials for the CRT. When the instrument is turned on, A3Q1 starts to conduct through the primary winding (pins 1 and 2) of high voltage transformer A3A4A1T1. Positive feedback to the base of A3Q1 occurs from the tertiary winding (pins 3 and 4) of the transformer and the circuit oscillates at a rate determined by the distributed inductance and capacitance of the circuit. The magnitude of the oscillations, and consequently the output of the power supply, is controlled by the voltage on the collector of A3A4Q3. A sample of the +15-volt power supply (through A3A4R1 and A3A4R2) establishes a reference at the base of A3A4Q1. A sample of the -2150-volt output of the power supply is fed back to the base of A3A4Q1 and compared with the reference voltage. Any difference is amplified and inverted by Darlington amplifier A3A4Q1/A3A4Q2. The output of the Darlington pair drives the base of A3A4Q3, causing its collector voltage to change. This change is reflected through the tertiary winding of the transformer to the base of A3Q1 and causes the amplitude of its oscillations to change. The change is in such a direction as to correct the original change in the output voltage of the power supply.

4-175. The output of the gate assembly (schematic 17) is connected between the positive side of the -2220-volt output and ground. Any variation in the gate voltage, varies the total voltage on the intensity control grid of the CRT and controls the brightness (or blanking) of the CRT.

4-176. High voltage multiplier A3A4A2 quadruples the output from pin 8 of the high voltage transformer and supplies a potential of 20 kilovolts for the post-accelerator of the CRT.

Instrument		Required Characteristics	Required for (See Note)
Type	Model		
Voltmeter Calibrator	HP Model H01-H01-738BR	Voltage: 5 mV to 150V Accuracy: to 0.1%	P, A
Oscillator	HP Model 204C	Frequency: 100 kHz Voltage output 15 mV	P, A
Time-mark Generator	HP Model 226	Time Marks: 50 ns to 2 sec	P, A
Square-wave Generator	HP Model 211B	Frequency: 100 kHz; <5 ns	P, A
Multifunction Digital Voltmeter	HP Model 34740A with 34702A	Voltage Range: 1000V Accuracy: $\pm 0.1\%$ Resistance Range: 10 megohms Accuracy: $\pm 0.1\%$	P, A, T
Constant-amplitude Signal Generator	HP Model 4640A OPT 001	Frequency: 50 kHz to 75 MHz Voltage Output: 50 mV to 5V p-p	P
LC Meter	HP Model 4332A	Range: 30 pF	A
50-ohm Feed-through Termination	HP Model 10100C	Resistance: 50 ohms	P, A
RG 213 Cable	RG 213	50-ohm Cable	P, A
BNC Cable (two required)	HP Model 10501A Cable Assembly	BNC 44 in.	P, A
BNC Cable (two required)	HP Model 10502A	BNC 9 in.	P, A
Banana Jack to BNC Adapter	HP Model 10110A	Banana Jack to BNC	P, A
Adapter	HP Model 10111A	BNC to Binding Post	P, A
Adapter	HP Model 10219A	UHF to BNC Female Adapter	P, A
BNC Tee (two required)	HP Part No. 1250-0781	BNC Connectors	P, A
Test Leads	HP Model 11002A	Test Leads	P, A, T
10:1 Divider	HP Model 10006B	Divide Ratio: 10:1 Accuracy: $\pm 3\%$	P, A
RF Millivoltmeter	HP Model 3406A	Range: 100 mV	P
1000:1 Divider	HP Model K05-3440A	Divide Ratio: 1000:1 Accuracy: $\pm 3\%$	A
Monitor Oscilloscope	HP Models 180C, 1808A and 1820C	Bandwidth: 50 MHz	A, T
Screwdriver	HP Part No. 8710-0900	Pozidrive	A, T
Service Kit	HP Part No. 01701-68701	Extender Boards and Board Puller	A, T
Note: P = Performance Check, A = Adjustment Procedure, T = Troubleshooting			

SECTION V

PERFORMANCE CHECK AND ADJUSTMENTS

5-1. INTRODUCTION.

5-2. This section contains step-by-step procedures for checking the instrument specifications as given in table 1-1 of this manual. The performance check procedure gives troubleshooting suggestions in case the instrument fails to meet any specification tested. A table (performance check record) is provided at the end of the performance check for recording the measurements obtained in the first running of the procedures. The record may be used to compare measurements taken at later dates with the original. The procedures for making all internal adjustments are covered in paragraphs 5-138 through 5-234. A photograph showing the locations of all internal adjustment controls is presented in figure 5-19.

5-3. TEST EQUIPMENT.

5-4. Test equipment required for procedures in this section is listed in table 5-1. Test equipment equivalent to that recommended may be substituted, provided it meets the required characteristics listed in the table. For best results, use recently calibrated test equipment.

5-5. PERFORMANCE CHECK.

5-6. The following subparagraphs describe procedures to determine whether or not the instrument is operating within the specifications of table 1-1. This can be used as part of an incoming inspection, as a periodic operational test, or to check calibration after repairs or adjustments have been made. Any one of the following checks can be made separately if desired.

5-7. The first time the performance check is made, enter the results on the performance check record at the end of the procedure. Remove the record from the manual and file it for future reference. Be sure to include the instrument serial number on the record for identification.

5-8. FRONT-PANEL ADJUSTMENTS.

5-9. Set the instrument up and perform initial adjustments outlined in Section III before proceeding with the performance checks or adjustment procedures.

5-10. FRONT-PANEL SETTINGS.

5-11. The control settings listed below are to be used in each performance test and adjustment procedure.

Begin each test or adjustment with the controls set to these positions. If a control is to be set to another position, it will be listed in the procedures. After the completion of each performance check or adjustment procedure, the controls should be set back to the original front panel setting. Set controls as follows:

VOLTS/DIV (A and B)	.01
coupling (A and B)	AC
verniers (A and B)	CAL
POSITION (A and B)	as required
DISPLAY	A
trig	NORM TRIG
B POLARITY	NORM
HORIZONTAL POSITION	as required
main VERNIER	CAL
delayed VERNIER	CAL
sweep display	MAIN SWEEP
main TIME/DIV	5 usec
delayed TIME/DIV	OFF
AUTO/NORM	AUTO
AUTO/TRIG	AUTO
main INT/EXT	INT
delayed INT/EXT	INT
main slope	+
main TRIGGER LEVEL	as required for stable displays
delayed TRIGGER LEVEL	as required for stable displays
TRIGGER HOLDOFF	NORM
DELAY TIME	1.00
SWP MAG	X1
main HF REJ	disengaged
delayed HF REJ	disengaged
main LF REJ	disengaged

5-12. PERFORMANCE TESTS.

5-13. DEFLECTION FACTOR.

5-14. *Specification.* Ranges: from 10 mV/div to 5 V/div (9 ranges) in 1, 2, 5 sequence. Accuracy: $\pm 3\%$ with vernier in CAL position. Vernier: continuously variable between all ranges, extends maximum deflection factor to at least 12.5 V/div. VERNIER UNCAL light indicates when vernier is not in CAL position.

5-15. *Description.* The deflection factor is checked by applying a 400-Hz, voltage-calibrated signal to the input. The displayed signal is compared against the voltage standard.

5-16. Equipment.

- a. voltmeter calibrator.
- b. banana jack to BNC adapter.
- c. BNC cable, 44 in.

5-17. Procedure.

- a. Connect instruments as shown in figure 5-1.

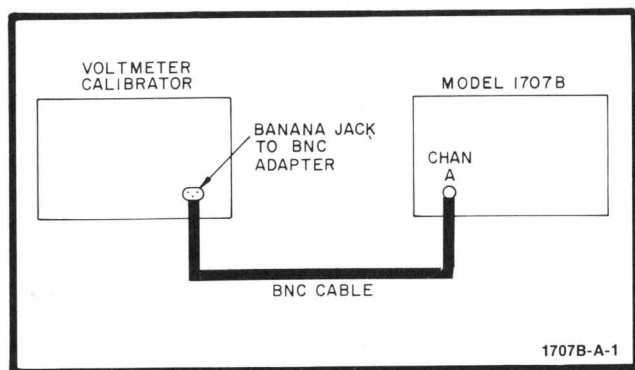


Figure 5-1. Deflection Factor Test Setup

- b. Set Model 1707B main TIME/DIV to .5 mSEC.
- c. Set voltmeter calibrator controls for 50-mV p-p output signal. Display should be 5 vertical div $\pm 3\%$.
- d. Observe vertical deflection factors specified in table 5-2.
- e. Adjust voltmeter calibrator and channel A VOLTS/DIV for 5 div of vertical deflection.
- f. Rotate channel A vernier fully ccw. VERNIER UNCAL light should be on. Vertical deflection should be less than 2.4 div.
- g. Rotate channel A vernier control fully clockwise into CAL detent.
- h. Connect voltmeter calibrator output to channel B INPUT.

- i. Set DISPLAY to B.
- j. Repeat steps b through f for channel B.
- k. Remove test equipment.
- l. To return to initial settings, set Model 1707B controls as follows:

DISPLAY..... A
 channel A and B VOLTS/DIV 01
 main TIME/DIV..... 5 uSEC
 verniers (A and B) CAL

- m. Refer to schematics 3 through 7 if any deflection factor is not within specifications.

5-18. RISE TIME.

5-19. *Specification.* Rise time is less than 4.7 ns; direct or with Model 10006B Probe. Rise time is measured from 10% to 90% with 6-div input step from a terminated 50-ohm source.

5-20. *Description.* A 100 kHz signal with a rise time of less than 1 ns is applied to the vertical input of the instrument. The rise time displayed on the CRT is then checked to see that it is less than 4.7 ns. This measurement is made direct, but may be made with Model 10006B Probe.

5-21. Equipment.

- a. square-wave generator.
- b. 50-ohm feedthrough termination.
- c. BNC cable, 44 in.

5-22. Procedure.

- a. Connect instruments as shown in figure 5-2.
- b. Set Model 1707B main TIME/DIV to .1 uSEC.
- c. Set square-wave generator controls for 60-mV, 100-kHz output signal.

Table 5-2. Deflection Factor Accuracy

Voltmeter Calibrator Settings (Volts p-p)	VOLTS/DIV Settings	Vertical Display (div)
0.05	.01	5 ± 0.15 div
0.1	.02	5 ± 0.15 div
0.3	.05	6 ± 0.18 div
0.5	.1	5 ± 0.15 div
1	.2	5 ± 0.15 div
3	.5	6 ± 0.18 div
5	1	5 ± 0.15 div
10	2	5 ± 0.15 div
30	5	6 ± 0.18 div

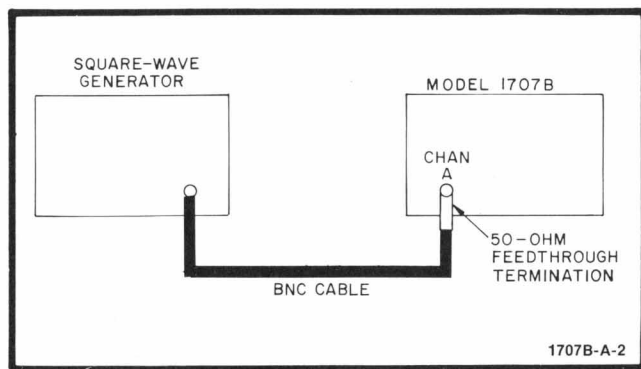


Figure 5-2. Rise Time Test Setup

d. Adjust HORIZONTAL POSITION control so rise time portion of signal is in center of CRT.

e. Set SWP MAG to X10.

f. Measure pulse rise time between 10% and 90% points (dotted lines on CRT). Rise time should be less than 4.7 ns.

g. Connect square-wave generator output to channel B INPUT.

h. Set DISPLAY to B.

i. Repeat steps b through f for channel B.

j. Remove test equipment.

k. To return to initial settings, set Model 1707B controls as follows:

DISPLAY..... A
main TIME/DIV..... 5 uSEC
SWP MAG..... X1

l. Refer to schematics 3 through 7 if rise time specification is not met.

5-23. BANDWIDTH.

5-24. Specification. (Direct or with Model 10006B Probe, 3-dB down from 50-kHz, 6-div reference signal from a terminated 50-ohm source). Dc coupled: dc to 75 MHz, ac coupled: 10 Hz to 75 MHz.

5-25. Description. To check bandwidth, a constant-amplitude signal generator is used to apply a 6-div, 50-kHz signal to the Model 1707B input. The constant-amplitude signal generator frequency is increased to 75 MHz. The signal amplitude displayed on the CRT must always be equal to or greater than 4.3 div to meet bandwidth specifications. This measurement is made direct, but may be made with Model 10006B Probe.

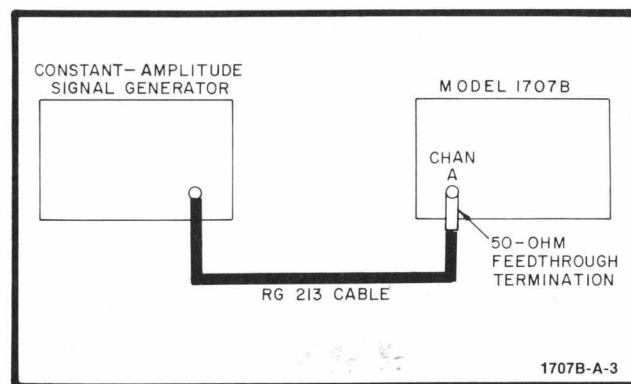


Figure 5-3. Bandwidth Test Setup

5-26. Equipment.

- constant-amplitude signal generator.
- RG 213 cable.
- 50-ohm feedthrough termination.

5-27. Procedure.

- Connect instruments as shown in figure 5-3.
- Set constant-amplitude signal generator controls for 60-mV, 50-kHz output signal.
- Adjust main TRIGGER LEVEL for stable display.
- Adjust constant-amplitude signal generator voltage vernier for 6-div vertical display.
- Set constant-amplitude signal generator controls for frequency output of 75 MHz. Vertical display of CRT should be equal to or greater than 4.3 div.
- Connect constant-amplitude signal generator to channel B.

g. Set DISPLAY to B.

h. Repeat steps b through e for channel B.

i. Remove test equipment.

j. To return to initial settings, set DISPLAY to A.

k. Refer to schematics 3 through 7 if either channel does not meet bandwidth specification.

5-28. A + B MODE.

5-29. Specification. Vertical deflection within $\pm 3\%$ of VOLTS/DIV switch indication with the addition of channel A and B.

5-30. *Description.* The deflection factor of the added signal is checked by applying a signal to both channel A and B. The displayed signal should be the algebraic sum of channel A and B. Proper operation of channel B POLARITY switch is also verified.

5-31. *Equipment.*

- Oscillator.
- BNC cable, 44 in. (2 required).
- BNC TEE connector.

5-32. *Procedure.*

- Connect instruments as shown in figure 5-4.

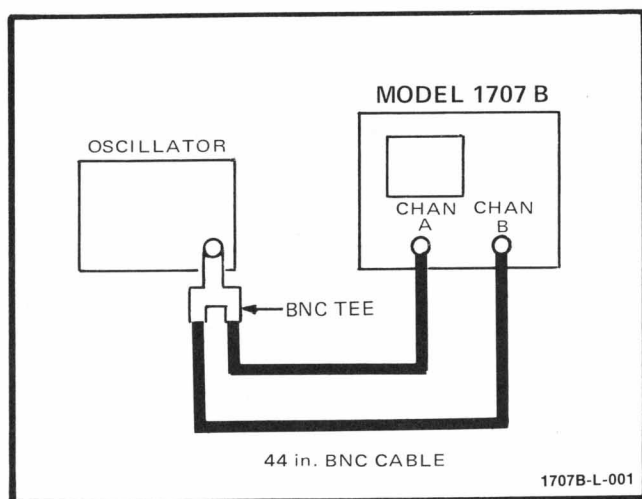


Figure 5-4. A + B Mode Test Setup

- Set oscillator for 100 mV output at 1 kHz.
- Set main TIME/DIV to .5 mSEC.
- Set DISPLAY to A + B.
- Set channel A and B VOLTS/DIV switches to 0.1.
- CRT display should be 2 divisions.
- Set B POLARITY to INVT.
- CRT display should be straight line.
- Remove test equipment.
- To return to initial settings, set Model 1707B controls as follows:

DISPLAY.....	A
VOLTS/DIV (A and B)	.01
B POLARITY.....	NORM
MAIN TIME/DIV	5 uSEC

- Refer to schematics 3 through 7 if instrument does not meet specification.

5-33. **ALT MODE.**

5-34. *Specification.* Trace alternates between channel A and channel B at all sweep rates.

5-35. *Description.* Signals are applied to channel A and channel B. The display should alternate between channel A and channel B on successive sweeps.

5-36. *Equipment.*

- Oscillator.
- BNC cable.
- BNC tee.

5-37. *Procedure.*

- Connect instruments as shown in figure 5-4.
- Set oscillator for .5 volts output at 100 kHz.
- Set both channel A and B VOLTS/DIV switches to .5.
- Set DISPLAY switch to ALT.
- Position traces about 2 divisions apart.
- Rotate TIME/DIV switch throughout its range.
- Display should alternate between traces at all positions of TIME/DIV switch. At faster sweep rates, alternation will appear as two traces on screen.
- Remove test equipment.
- To return to initial settings set Model 1707B controls as follows:

DISPLAY.....	A
TIME/DIV	5 usec
VOLTS/DIV (A and B)	.01

- Refer to schematics 3 through 7 if ALT mode does not meet specifications.

5-38. **CHOP MODE.**

5-39. *Specifications.* Electronically switched between channels at approx 400 kHz. Blanking during switching.

5-40. *Description.* Signals applied to channel A and channel B in CHOP mode. Check for proper blanking.

5-41. Equipment.

- a. Oscillator.
- b. BNC cable.
- c. BNC tee.

5-42. Procedure.

- a. Connect instruments as shown in figure 5-4.
- b. Set DISPLAY switch to CHOP.
- c. Set TIME/DIV switch to 20 usec.
- d. Set oscillator for approximately 5 kHz output frequency at .5V p-p.
- e. Set both VOLTS/DIV to .5.
- f. Adjust TRIGGER LEVEL control to produce a stable display.
- g. At slower sweep speeds, display should consist of two separate sine wave displays.
- h. At faster sweep speeds, the two separate displays will appear as dashed lines.
- i. Check to see that switching transients between segments are completely blanked.
- j. Remove test equipment.
- k. To return to initial settings, set Model 1707B controls as follows:

DISPLAY	A
TIME/DIV	5 usec
VOLTS/DIV (A and B)	.01

- l. Refer to schematic 3 through 7 if CHOP mode specifications are not met.

5-43. SINGLE SWEEP.

5-44. Specification. Sweep locks out until RESET is pressed.

5-45. Description. Signal is applied to channel A INPUT and instrument is set to single sweep operation. Sweep is armed when RESET pushbutton is pressed.

5-46. Equipment.

- a. None required.

5-47. Procedure.

- a. Connect CAL 1 VOLT output to channel A INPUT.
- b. Set main TIME/DIV to 1 mSEC.
- c. Set channel A VOLTS/DIV to .5.
- d. Set AUTO/NORM to NORM.
- e. Adjust TRIGGER LEVEL to obtain stable display.
- f. Disconnect signal.
- g. Set sweep mode to SINGLE.
- h. Press RESET button.
- i. RESET indicator illuminates and remains illuminated until signal is reapplied.
- j. Reconnect signal to channel A INPUT.
- k. A single, stable display should be presented and RESET indicator should extinguish.
- l. Remove test equipment.
- m. Refer to schematic 10 if specification is not met.
- n. To return to initial settings, set Model 1707B controls as follows:

SINGLE	disengaged
AUTO/NORM	AUTO
VOLTS/DIV (A)	.01
main TIME/DIV	5 uSEC

5-48. AUTO TRIG RECOVERY TIME.

5-49. Specification. Stable display above 40 Hz.

5-50. Description. A time marker display of greater than 40 Hz is obtained, indicating that the time base is synchronizing on triggers, then a trigger signal of less than 40 Hz is applied, indicating that time base is running at 40 Hz, and is not triggering on signal.

5-51. Equipment.

- a. Time-mark generator.
- b. BNC cable 44 in.

5-52. Procedure.

- a. Connect time-mark generator to channel A INPUT.

- b. Set time-mark generator for 50-millisecond markers.
- c. Set channel A VOLTS/DIV switch to 2.
- d. Set TIME/DIV switch to 50 ms.
- e. Adjust TRIGGER LEVEL to obtain stable display.
- f. Set time-mark generator for 500-millisecond markers.
- g. Sweep should free run and stable display cannot be obtained.
- h. Remove test equipment.
- i. To return to initial settings, set Model 1707B controls as follows:

VOLTS/DIV (A) 01
TIME/DIV 5 usec

- j. Refer to schematic 10 if specification cannot be met.

5-53. Z AXIS SENSITIVITY.

5-54. *Specification.* Noticeable intensity modulation with 4-volt signal.

5-55. *Description.* A 4-volt signal is applied to Z AXIS INPUT to blank trace.

5-56. *Equipment.*

- a. Oscillator.
- b. BNC cable.

5-57. *Procedure.*

- a. Set oscillator for a 4-volt p-p output at approximately 1 kHz.
- b. Connect oscillator to Z AXIS INPUT.
- c. Set TIME/DIV to 1 mSEC.
- d. CRT display should show noticeable intensity modulation.
- e. Remove test equipment.
- f. Refer to schematic 19 if specification cannot be met.
- g. To return to initial settings, set Model 1707B controls as follows:

main TIME/DIV 5 uSEC

5-58. BEAM FINDER.

5-59. *Specification.* Intensity is increased and display returns to display area when BEAM FINDER is pressed.

5-60. *Description.* Display is positioned off screen. BEAM FINDER pushbutton is pressed to return display to viewing area.

5-61. *Equipment.*

- a. None required.

5-62. *Procedure.*

- a. Connect CAL 1 VOLT signal to channel A INPUT.

- b. Set main TIME/DIV to .2 mSEC.

- c. Adjust TRIGGER LEVEL for stable display.

- d. Set channel A VOLTS/DIV to 1.

- e. Adjust channel A POSITION completely ccw.

f. Press BEAM FINDER and observe that display is intensified, reduced in size and returned to viewing area.

g. While pressing BEAM FINDER adjust channel A POSITION to position display at center screen.

h. Release BEAM FINDER and observe that display remains on screen.

- i. Disconnect CAL 1 VOLT.

j. To return to initial settings, set Model 1707B controls as follows:

VOLTS/DIV (A) 01

- k. Refer to schematics 6, 16 and 17 if this specification cannot be met.

5-63. COUPLING SWITCH.

5-64. *Specification.* Correct signal coupling in each switch position.

5-65. *Description.* Correct coupling switch application is checked by applying a signal to channels A and B and verify switch position agrees with display.

5-66. *Equipment.*

- a. None required.

5-67. Procedure.

- a. Connect channel A INPUT to CAL 1 VOLT output.
- b. Set main TIME/DIV to .5 mSEC.
- c. Set channel A VOLTS/DIV to .5.
- d. Set channel A coupling switch to DC.
- e. Position bottom of display on center graticule line.
- f. Set channel A coupling switch to AC.
- g. CRT display should be centered about center graticule line.
- h. Set channel A coupling switch to GND.
- i. CRT display should be a straight line near center graticule.
- j. Set display switch to B and select B TRIG.
- k. Connect CAL 1 VOLT output to channel B INPUT.
- l. Set channel B VOLTS/DIV to .5.
- m. Center display around center graticule line.
- n. Set channel B coupling switch to DC.
- o. Bottom of CRT display should be on center graticule line.
- p. Set channel B coupling switch to GND.
- q. CRT display should be a straight line near center graticule.
- r. Disconnect CAL 1 VOLT input.

s. To return to initial settings, set Model 1707B controls as follows:

DISPLAY A
 COUPLING (A and B) AC
 VOLTS/DIV (A and B) 01
 triggering A TRIG

t. Refer to schematic 3 through 7 if specification is not met.

5-68. INPUT RESISTANCE.

5-69. Specification. The input is 1 megohm $\pm 2\%$ shunted by approximately 24 pF.

5-70. Description. The input resistance is measured with an ohmmeter to verify resistance.

5-71. Equipment.

- a. multifunction digital voltmeter.
- b. BNC cable, 44 in.
- c. banana jack to BNC adapter.

5-72. Procedure.

- a. Connect instruments as shown in figure 5-5.

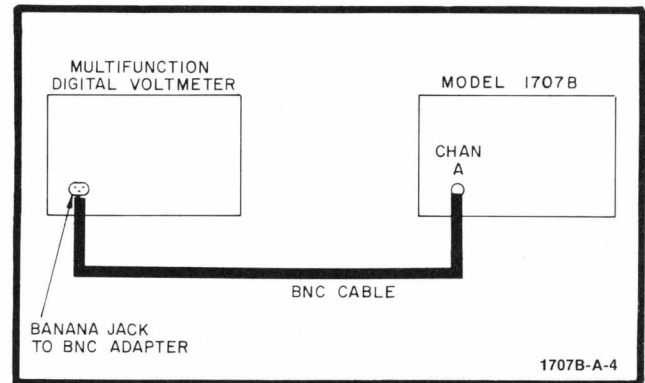


Figure 5-5. Input Resistance Test Setup

- b. Set Model 1707B channel A and B coupling to DC.
- c. Set multifunction digital voltmeter controls to measure 10 megohms.

NOTE

Use a range on the digital voltmeter having an output voltage less than 0.6V. If more than 0.6V is applied, erroneous input resistance readings may result.

d. Connect BNC cable to channel A INPUT. Multifunction digital voltmeter should indicate 1 megohm $\pm 2\%$.

- e. Check all channel A VOLTS/DIV ranges.
- f. Move BNC cable from channel A to channel B. Multifunction digital voltmeter should indicate 1 megohm $\pm 2\%$.
- g. Check all channel B VOLTS/DIV ranges.
- h. Remove test equipment.
- i. To return to initial settings, set Model 1707B controls as follows:

channel A and B VOLTS/DIV 01
 channel A and B coupling AC

j. Refer to schematic 3 if input resistance specification is not met.

5-73. COMMON MODE REJECTION RATIO (CMRR).

5-74. *Specification.* Frequency: dc to 1 MHz. CMRR: at least 40 dB on 10 mV/div range, at least 20 dB on all other ranges with verniers set for optimum rejection.

5-75. *Description.* This measurement is made by applying identical signals to channel A and channel B and operating in the A+B (B POLARITY INVT) mode. The signal display on the CRT will be the common mode signal.

5-76. Equipment.

- constant-amplitude signal generator.
- BNC cable, 9 in.
- BNC tee.
- RG 213 cable.
- 50-ohm feedthrough termination.

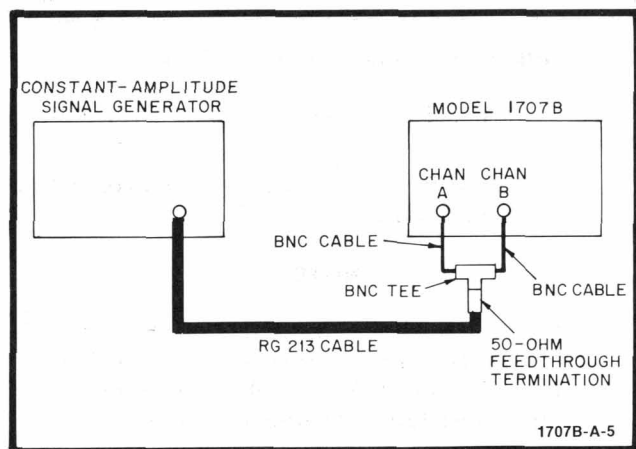


Figure 5-6. CMRR Test Setup

5-77. Procedure.

- Connect instruments as shown in figure 5-5.
- Set Model 1707B channel A VOLTS/DIV to .05.
- Set constant-amplitude signal generator controls for 50-kHz, 0.3V p-p signal as viewed on Model 1707B CRT.
- Set DISPLAY switch to A+B.
- Set channel A and B VOLTS/DIV to .01.
- Set B POLARITY switch to INVT. Display should be less than 0.3 div.

g. Increase constant-amplitude signal generator frequency to 1 MHz. Display should be less than 0.3 div.

h. For all other vertical sensitivity ranges (VOLTS/DIV), 30 div of signal at 1 MHz applied to channel A and B INPUT will result in deflection factor equal to or less than 3 div. This deflection factor is with channel A and channel B vernier adjusted for maximum CMRR.

i. Remove test equipment.

j. To return to initial settings, set Model 1707B controls as follows:

DISPLAY..... A
B POLARITY..... NORM
channel A and channel B VOLTS/DIV... .01
channel A and B verniers CAL

k. Refer to schematics 3 through 7 if CMRR specification is not met.

5-78. MAIN SWEEP TIME.

5-79. *Specification.* Range: from 0.1 usec/div to 2 sec/div (23 ranges) in 1, 2, 5 sequence. Accuracy is $\pm 3\%$ with VERNIER in CAL position. VERNIER: continuously variable between all ranges; extends slowest sweep to at least 5 sec/div. VERNIER UNCAL light indicates when VERNIER is not in CAL position. Magnifier: expands all sweeps by a factor of 10 and extends the fastest sweep speed to 10 ns/div. Accuracy is $\pm 5\%$, includes $\pm 3\%$ accuracy of time base.

5-80. *Description.* The instrument time base is compared against a time-mark generator to verify specifications.

5-81. Equipment.

- time-mark generator.
- BNC cable, 44 in.

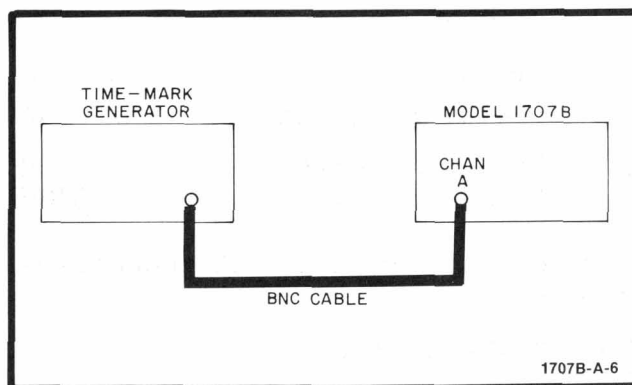


Figure 5-7. Main Sweep Time Test Setup

5-82. Procedure.

- a. Connect instruments as shown in figure 5-7.
- b. Set Model 1707B controls as follows:

channel A VOLTS/DIV approx 5 div
of deflection

main TIME/DIV 1 uSEC
- c. Set time-mark generator controls for 0.1-usec time-mark output.
- d. Adjust HORIZONTAL POSITION control so first marker is aligned with first, left-hand vertical graticule. Eleven markers should be present on CRT.
- e. Check rest of main TIME/DIV settings using table 5-3.
- f. Set main TIME/DIV switch to 1 uSEC.
- g. Set time-mark generator for 5-usec time-mark output.
- h. Adjust HORIZONTAL POSITION control so three time marks appear on CRT.
- i. Rotate main VERNIER fully counterclockwise. VERNIER UNCAL light should be on. Time period between time marks should be less than 2 div.
- j. Return main VERNIER to CAL position.
- k. Set time-mark generator for 1-usec time-mark output. Eleven time marks should appear on CRT.

- l. Set SWP MAG to X10.

m. Adjust HORIZONTAL POSITION control until two time marks appear. Time marks should be 10 div apart ± 0.5 div.

- n. Remove test equipment.

o. To return to initial settings, set Model 1707B controls as follows:

channel A VOLTS/DIV 01
main TIME/DIV 5 uSEC
SWP MAG X1

p. Refer to following paragraphs and schematics if any of these tests fail:

- (1). Sweep ranges: paragraph 5-185 and schematic 11.
- (2). VERNIER check: schematic 11.
- (3). SWP MAG (X10) check: paragraph 5-195, schematic 16.

5-83. DELAYED SWEEP TIME.

5-84. Specification. Ranges: from 0.1 usec/div to 0.2 sec/div (20 ranges) in a 1, 2, 5 sequence. Accuracy: $\pm 3\%$ with VERNIER in CAL position. VERNIER: continuously variable between all ranges; extends slowest sweep speed to at least 0.5 sec/div. VERNIER UNCAL light indicates when VERNIER is not in CAL position.

Table 5-3. Main Sweep Performance Check

Time-mark Generator	Main TIME/DIV	Time Marks To Check
0.1 usec	.1 uSEC	 11 in 10 div ± 0.3 div
0.2 usec	.2 uSEC	
0.5 usec	.5 uSEC	
1 usec	1 uSEC	
2 usec	2 uSEC	
5 usec	5 uSEC	
10 usec	10 uSEC	
20 usec	20 uSEC	
50 usec	50 uSEC	
0.1 ms	.1 mSEC	
0.2 ms	.2 mSEC	
0.5 ms	.5 mSEC	
1 ms	1 mSEC	
2 ms	2 mSEC	
5 ms	5 mSEC	
10 ms	10 mSEC	
20 ms	20 mSEC	
50 ms	50 mSEC	
0.1 sec	.1 SEC	
0.2 sec	.2 SEC	
0.5 sec	.5 SEC	
1 sec	1 SEC	
2 sec	2 SEC	

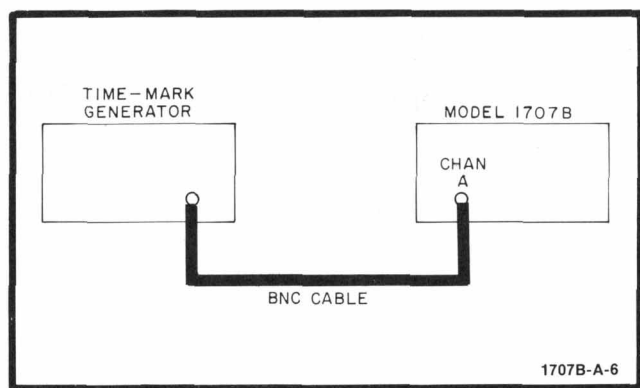


Figure 5-8. Delayed Sweep Time Test Setup

5-85. *Description.* The delayed time base is compared against a time-mark generator to verify specifications.

5-86. *Equipment.*

- a. time-mark generator.
- b. BNC cable, 44 in.

5-87. *Procedure.*

- a. Connect instruments as shown in figure 5-8.
- b. Set Model 1707B controls as follows:

channel A VOLTS/DIV approx 5 div
of deflection
delayed TIME/DIV 1 uSEC
sweep display DELAYED SWEEP
main TIME/DIV 2 uSEC

c. Set time-mark generator controls for 0.1- μ sec time-mark output.

d. Adjust HORIZONTAL POSITION controls so first marker is aligned with first, left-hand vertical graticule. Eleven markers should be present on screen.

e. Check rest of delayed TIME/DIV settings using table 5-4. Main TIME/DIV control should be one step slower than delayed TIME/DIV.

f. Set delayed TIME/DIV switch to 1 mSEC.

g. Set time-mark generator for 5-ms time marks.

h. Adjust DELAY TIME until three time marks appear on CRT.

i. Rotate delayed VERNIER fully counterclockwise. VERNIER UNCAL light should be on. Time period should be equal to or less than 2 div.

NOTE

Sweep length decreases as delayed VERNIER is turned counterclockwise.

- j. Return delayed VERNIER to CAL position.
- k. Remove all test equipment.
- l. To return to initial settings, set Model 1707B controls as follows:

channel A VOLTS/DIV 01
delayed TIME/DIV OFF
sweep display MAIN SWEEP
main TIME/DIV 5 uSEC

m. Refer to paragraph 5-190 and schematic 13 if any tests fail.

5-88. DELAY TIME ACCURACY.

5-89. *Specification.* Accuracy: $\pm 1\%$.

5-90. *Description.* The delay time accuracy is checked against a calibrated standard to verify accuracy.

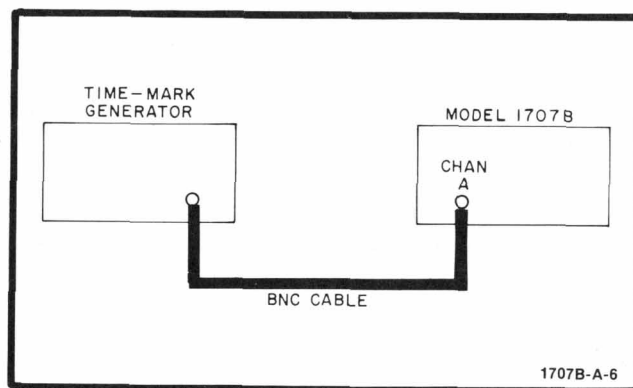


Figure 5-9. Delay Time Accuracy Test Setup

5-91. *Equipment.*

- a. time-mark generator.
- b. BNC cable, 44 in.

5-92. *Procedure.*

- a. Connect instruments as shown in figure 5-9.
- b. Set Model 1707B controls as follows:

channel A VOLTS/DIV approx 5 div
of deflection
main TIME/DIV 1 mSEC
delayed TIME/DIV 10 uSEC

c. Set time-mark generator for 1-ms time-mark output.

d. Adjust DELAY TIME to intensify second time mark from left.

e. Set sweep display to DELAYED SWEEP.

f. Adjust DELAY TIME to center visible time mark on center vertical graticule line. Note DELAY TIME setting.

DELAY TIME _____

g. Set sweep display to MAIN SWEEP.

h. Adjust DELAY TIME to intensify 10th time mark from left.

i. Set sweep display to DELAYED SWEEP.

j. Adjust DELAY TIME to center visible time mark on center vertical graticule line. Note DELAY TIME setting.

DELAY TIME _____

k. Subtract setting in step f from step j. Difference should be 8.00 ± 0.08 .

l. Disconnect test equipment.

m. To return to initial settings, set Model 1707B controls as follows:

channel A VOLTS/DIV 01
sweep display MAIN SWEEP
main TIME/DIV 5 uSEC
delayed TIME/DIV OFF

Table 5-4. Delayed Sweep Performance Check

Time-mark Generator	Delayed TIME/DIV	Time Marks to Check
0.1 usec	.1 uSEC	11 in 10 div ± 0.3 div
0.2 usec	.2 uSEC	
0.5 usec	.5 uSEC	
1 usec	1 uSEC	
2 usec	2 uSEC	
5 usec	5 uSEC	
10 usec	10 uSEC	
20 usec	20 uSEC	
50 usec	50 uSEC	
0.1 ms	.1 mSEC	
0.2 ms	.2 mSEC	
0.5 ms	.5 mSEC	
1 ms	1 mSEC	
2 ms	2 mSEC	
5 ms	5 mSEC	
10 ms	10 mSEC	
20 ms	20 mSEC	
50 ms	50 mSEC	
0.1 sec	.1 SEC	
0.2 sec	.2 SEC	

n. Refer to paragraph 5-190 and schematics 13 and 14 if specification is not met.

5-93. DELAY TIME LINEARITY.

5-94. Specification. Linearity: $\pm 0.2\%$.

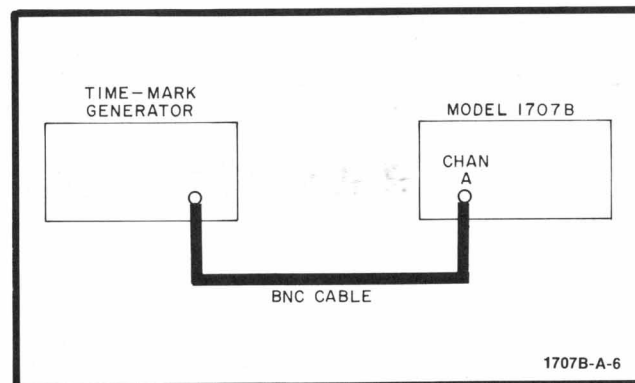


Figure 5-10. Delay Time Linearity Test Setup

5-95. Description. The linearity of the DELAY TIME dial is checked against a calibrated standard to verify linearity.

5-96. Equipment.

- time-mark generator.
- BNC cable, 44 in.

5-97. Procedure.

- Connect instruments as shown in figure 5-10.

- b. Set Model 1707B controls as follows:

channel A VOLTS/DIV approx 5 div
of deflection
sweep display DELAYED SWEEP
main TIME/DIV 1 ms
DELAY TIME 0.00
DELAY TIME/DIV 10 uSEC

- c. Set time-mark generator for 1-ms time-mark output.

- d. Rotate DELAY TIME cw until first marker is centered on center graticule line. Note DELAY TIME setting.

(A) DELAY TIME _____

- e. Adjust DELAY TIME cw until fifth marker is centered on center vertical graticule line. Note DELAY TIME setting.

(B) DELAY TIME _____

- f. Adjust DELAY TIME cw until ninth marker is centered on center vertical graticule line. Note DELAY TIME setting.

(C) DELAY TIME _____

- g. Perform mathematics given below. Note result of 0.00 ± 0.02 .

$$A + \frac{\left(\frac{C - A}{2}\right) - B}{2} = 0.00 \pm 0.02$$

Where: A = step d setting
B = step e setting
C = step f setting

Result: $-.02$ _____ $+.02$

- h. Disconnect test equipment.

- i. To return to initial settings, set Model 1707B controls as follows:

channel A VOLTS/DIV 01
sweep display MAIN SWEEP
delayed TIME/DIV OFF
main TIME/DIV 5 uSEC
DELAY TIME 0.00

- j. Refer to schematics 12 and 13 if specification is not met.

5-98. DELAY JITTER.

- 5-99. *Specification.* Delay jitter should be less than .005%.

5-100. *Description.* The delay jitter is checked by expanding the sweep by 20,000 and visually monitoring the jitter.

5-101. Equipment.

- time-mark generator.
- BNC cable, 44 in.

5-102. Procedure.

- Connect instruments as shown in figure 5-11.

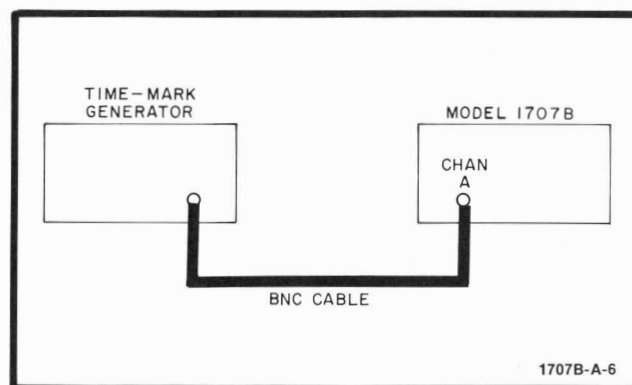


Figure 5-11. Delay Jitter Test Setup

- Set Model 1707B controls as follows:

channel A VOLTS/DIV approx 5 div
of deflection
main TIME/DIV 1 mSEC
delayed TIME/DIV 5 uSEC

- Set time-mark generator controls for 1-ms time-mark output.

- Adjust DELAY TIME so intensified portion of sweep is at 11th graticule line.

- Set sweep display to DELAYED SWEEP.

- Adjust DELAY TIME so display is centered. Display jitter should be less than 1 div which is less than .005%.

- Remove test equipment.

- To return to initial settings, set Model 1707B controls as follows:

channel A VOLTS/DIV 01
main TIME/DIV 5 uSEC
delayed TIME/DIV OFF
sweep display MAIN SWEEP
DELAY TIME 0.00

- Refer to schematics 12 and 13 if specifications are not met.

5-103. MAIN TRIGGERING.

5-104. Specification. Dc to 35 MHz on signals causing 0.5 div of vertical deflection, increasing to 1 div at 75 MHz in all display modes except CHOP; dc to 400 kHz in CHOP mode. External: dc to 35 MHz on signals 50 mV p-p or more, increasing to 100 mV p-p at 75 MHz.

5-105. Description. The main triggering is checked with known input signals to ensure proper triggering.

5-106. Equipment.

- a. constant-amplitude signal generator.
- b. RF millivoltmeter.
- c. BNC tee (2).
- d. BNC cable, 9 in (2).
- e. RG 213 cable.
- f. 50-ohm feedthrough termination.
- g. 10:1 divider probe.

5-107. Procedure.

- a. Connect instruments as shown in figure 5-12.

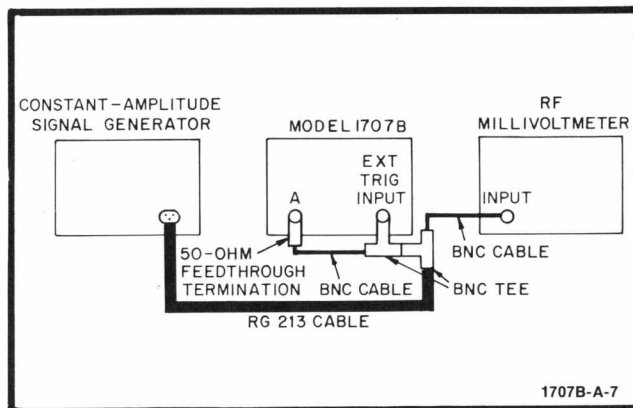


Figure 5-12. Main Triggering Test Setup

- b. Set Model 1707B controls as follows:

main TIME/DIV..... .1 μ SEC
 SWP MAG..... X10
 channel A VOLTS/DIV..... .1

- c. Set constant-amplitude signal generator controls for 35-MHz, 0.5-div display.

- d. Adjust main TRIGGER LEVEL for stable display.

If stable display is obtained, instrument is triggering properly.

- e. Without increasing amplitude set constant amplitude signal generator for 75-MHz output.

- f. Display should not trigger at any setting of TRIGGER LEVEL control.

- g. Disengage HF REJ.

- h. Set constant-amplitude signal generator controls for 75-MHz, 1-div display output signal.

- i. Adjust main TRIGGER LEVEL for stable display. If stable display is obtained, instrument is triggering properly.

- j. Change trig to A ONLY TRIG and repeat steps b through i.

- k. Set main INT/EXT to EXT.

- l. Set constant-amplitude signal generator controls for 75-MHz, 35-mV rms (100-mV p-p) signal as read on RF millivoltmeter.

- m. Adjust main TRIGGER LEVEL for stable display. If stable display is obtained, instrument is triggering properly.

- n. Set constant-amplitude signal generator controls for 35-MHz, 7.5-mV rms (50-mV p-p) signal as read on RF millivoltmeter.

- o. Adjust main TRIGGER LEVEL for stable display. If stable display is obtained, instrument is triggering properly.

- p. Set main INT/EXT to INT.

- q. Set SWP MAG to X1.

- r. Set DISPLAY to CHOP.

- s. Set main TIME/DIV control to 2 μ SEC.

- t. Set constant-amplitude signal generator controls for 400-kHz, 0.5-div display.

- u. Adjust main TRIGGER LEVEL for stable display. Segmented display should be observed. This is normal display.

- v. Remove test equipment.

- w. Connect 10:1 divider probe from channel A INPUT to ac line voltage source.

x. Set Model 1707B controls as follows:

main LF REJ engaged
 main HF REJ engaged
 channel A VOLTS/DIV 5
 channel A vernier ccw
 main TIME/DIV 2 mSEC

y. Adjust main TRIGGER LEVEL to obtain stable display. If stable display is obtained, instrument is triggering properly.

z. To return to initial settings, set Model 1707B controls as follows:

DISPLAY A
 channel A VOLTS/DIV 01
 main TIME/DIV 5 uSEC
 trig NORM TRIG

1. Refer to paragraph 5-172 and schematics 8 and 9 if any triggering specifications are not met.

5-108. DELAYED TRIGGERING.

5-109. Specification. Dc to 35 MHz on signals causing 0.5 div of vertical deflection, increasing to 1.0 div at 75 MHz in all display modes except CHOP; dc to 400 kHz in CHOP mode. External: dc to 35 MHz on signals 50 mV p-p or more, increasing to 100 mV p-p at 75 MHz.

5-110. Description. The delayed triggering is checked with known input signals to ensure proper triggering.

5-111. Equipment.

- constant-amplitude signal generator.
- RF millivoltmeter.
- BNC tee (2).
- BNC cable, 9 in.
- BNC cable, 44 in.
- 50-ohm feedthrough termination.

5-112. Procedure.

- Connect instruments as shown in figure 5-13.
- Set Model 1707B controls as follows:

channel A VOLTS/DIV 1
 delayed TIME/DIV 1 uSEC
 main TIME/DIV 2 uSEC
 SWP MAG X10
 delayed AUTO/TRIG TRIG

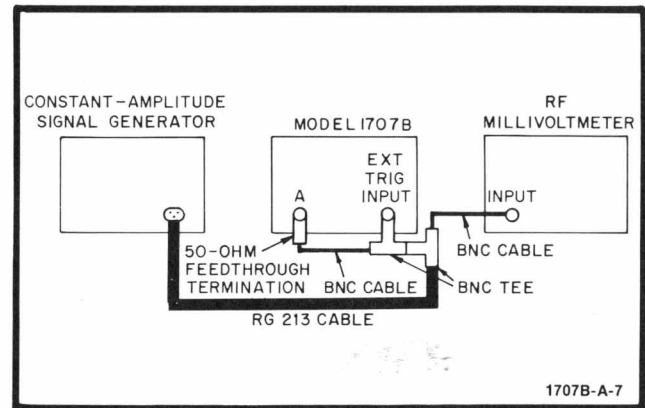


Figure 5-13. Delayed Triggering Test Setup

c. Set constant-amplitude signal generator controls for 35-MHz, 0.5-div display output signal.

d. Adjust main TRIGGER LEVEL for stable display.

e. Set sweep display to DELAYED SWEEP.

f. Adjust delayed TRIGGER LEVEL for stable display. If stable display is obtained, instrument is triggering properly.

g. Set sweep display to MAIN SWEEP.

h. Set constant-amplitude signal generator controls for 75-MHz, 1 div display output signal.

i. Adjust main TRIGGER LEVEL for stable display.

j. Set sweep display to DELAYED SWEEP.

k. Adjust delayed TRIGGER LEVEL for stable display. If stable display is obtained, instrument is triggering properly.

l. Set delayed INT/EXT to EXT.

m. Set sweep display to MAIN SWEEP.

n. Set constant-amplitude signal generator controls for 75-MHz, 35-mV rms (100-mV p-p) signal as read on RF millivoltmeter.

o. Adjust main TRIGGER LEVEL for stable display.

p. Set sweep display to DELAYED sweep.

q. Adjust delayed TRIGGER LEVEL for stable display. If stable display is obtained, instrument is triggering properly.

- r. Set sweep display to MAIN SWEEP.
- s. Set constant-amplitude signal generator controls for 35-MHz, 17.5-mV rms (50-mV p-p) signal as read on RF millivoltmeter.
- t. Adjust main TRIGGER LEVEL for stable display.
- u. Set sweep display to DELAYED SWEEP.
- v. Adjust delayed TRIGGER LEVEL for stable display. If stable display is obtained, instrument is triggering properly.
- w. Remove test equipment.
- x. To return to initial settings, set Model 1707B controls as follows:

delayed AUTO/TRIG AUTO
 delayed INT/EXT INT
 sweep display MAIN SWEEP
 channel A VOLTS/DIV 01
 main TIME/DIV 5 μ SEC
 delayed TIME/DIV OFF
 SWP MAG X1

- y. Refer to schematics 8 and 9 if any triggering specifications are not met.

5-113. MAIN TRIGGER LEVEL RANGE AND POLARITY.

5-114. Specification. The trigger level should adjust smoothly at any point on the vertical waveform for both the negative and positive portions of the signal. In EXT mode, stable triggering should occur from -1.2V to $+1.2\text{V}$ of trigger signal amplitude.

5-115. Description. The trigger level range and polarity are checked against calibrated inputs to ensure that the instrument triggers on both negative and positive slopes of the input signal.

5-116. Equipment.

- a. voltmeter calibrator.
- b. BNC cable, 44 in.
- c. BNC cable, 9 in. (2).
- d. BNC tee.
- e. banana jack to BNC adapter.

5-117. Procedure.

- a. Connect instruments as shown in figure 5-14.

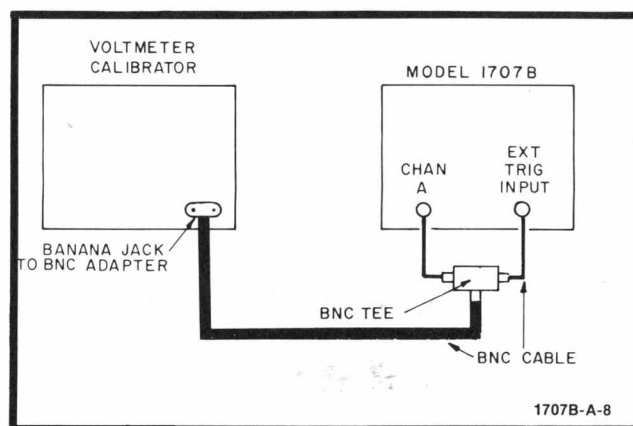


Figure 5-14. Main Trigger Level Range and Polarity Test Setup

- b. Set Model 1707B controls as follows:

channel A VOLTS/DIV 5
 main TIME/DIV 5 mSEC
 main HF REJ engaged

- c. Set voltmeter calibrator controls for 5V output signal.

- d. Rotate main TRIGGER LEVEL to both extremes. Triggering point should adjust smoothly across positive slope of waveform displayed on CRT.

- e. Set main slope to (—).

- f. Rotate main TRIGGER LEVEL to both extremes. Triggering point should adjust smoothly across negative slope of waveform displayed on CRT.

- g. Set main INT/EXT to EXT.

- h. Repeat steps a through f in EXT position. Triggering in EXT for both positive and negative slope should operate smoothly from -1.2V to $+1.2\text{V}$.

- i. Remove test equipment.

- j. To return to initial settings, set Model 1707B controls as follows:

channel A VOLTS/DIV 01
 main TIME/DIV 5 μ SEC
 main INT/EXT INT
 main slope +
 main HF REJ disengaged

- k. Refer to paragraph 5-167 and schematic 8 if any specifications are not met.

5-118. DELAYED TRIGGER LEVEL RANGE AND POLARITY.

5-119. Specification. The delayed trigger level should adjust smoothly at any point on the vertical waveform for both the negative and positive portions of the signal. In EXT mode, stable triggering should adjust from $-1.2V$ to $+1.2V$ of trigger signal amplitude.

5-120. Description. The trigger level range and polarity are checked against a calibrated input to ensure that the instrument triggers on both the negative and positive slopes of the input signal.

5-121. Equipment.

- voltmeter calibrator.
- BNC cable, 44 in.
- BNC tee.
- banana jack to BNC adapter.
- BNC cable, 9 in. (2).

5-122. Procedure.

- Connect instruments as shown in figure 5-15.

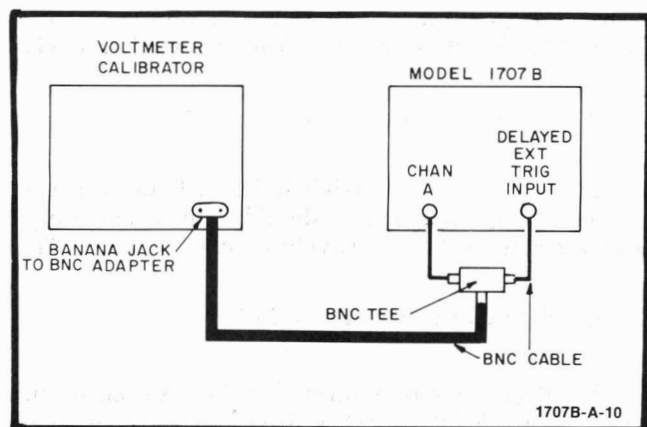


Figure 5-15. Delayed Trigger Level Range and Polarity Test Setup

- Set Model 1707B controls as follows:

sweep display DELAYED SWEEP
 channel A VOLTS/DIV 5
 main TIME/DIV 1 mSEC
 delayed HF REJ engaged
 delayed TIME/DIV 1 mSEC

- Set voltmeter calibrator controls for 0.5V output signal.

- Rotate delayed TRIGGER LEVEL to both extremes. Triggering point should adjust smoothly across positive slope of waveform displayed on CRT.

- Set delayed slope to (—).

- Rotate delayed TRIGGER LEVEL to both extremes. Triggering point should adjust smoothly across negative slope of waveform displayed on CRT.

- Set delayed INT/EXT to EXT.

- Repeat steps a through f in EXT position. Triggering in EXT for both positive and negative slope should operate smoothly from $-1.2V$ to $+1.2V$ of trigger signal amplitude.

- Remove test equipment.

- To return to initial settings, set Model 1707B controls as follows:

channel A VOLTS/DIV 01
 delayed INT/EXT INT
 delayed slope +
 delayed TIME/DIV OFF
 main TIME/DIV 5 uSEC
 sweep display MAIN SWEEP
 delayed HF REJ disengaged

- Refer to schematic 8 if any specifications are not met.

5-123. EXT HORIZONTAL BANDWIDTH.

5-124. Specification. Dc to 1 MHz.

5-125. Description. Bandwidth is checked by applying 50-Hz and 1-MHz signals to the EXT HORIZ INPUT and measuring the difference in trace deflection.

5-126. Equipment.

- Constant-amplitude Signal Generator.
- RG 213 Cable.
- 50-ohm Feedthrough Termination.

5-127. Procedure:

- Set up instruments as shown in figure 5-16.
- Set Model 1707B controls as follows:

sweep display EXT HORIZ INPUT
 SWP MAG X10
 SINGLE engaged

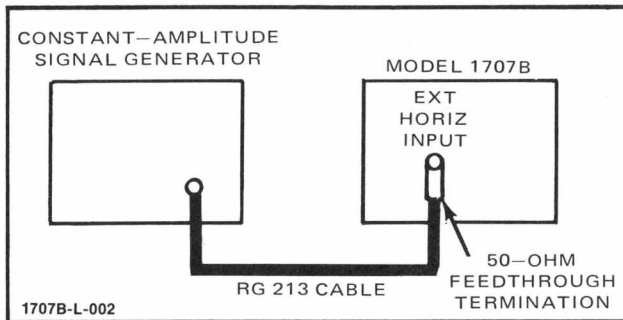


Figure 5-16. Ext Horizontal Bandwidth Test Setup

c. Set constant-amplitude signal generator controls for 1V, 50-kHz output signal.

d. Adjust constant-amplitude signal generator output to obtain exactly 10 div of horizontal deflection.

e. Adjust constant-amplitude signal generator frequency to obtain 1-MHz output signal. Horizontal deflection shall be equal to or greater than 7.2 div.

f. Disconnect test equipment.

g. To return to initial settings, set Model 1707B controls as follows:

sweep display	MAIN SWEEP
SWP MAG	X1
SINGLE	disengaged

h. Refer to schematic 13 if specification is not met.

5-128. EXT HORIZONTAL DEFLECTION FACTOR.

5-129. *Specification.* SWP MAG (X1), 1 V/div; SWP MAG (X10), 0.1 V/div. Accuracy: $\pm 5\%$.

5-130. *Description.* A voltmeter calibrator signal (1V or 10V at 400 Hz) is applied to the EXT HORIZ INPUT and horizontal deflection is measured to vertical deflection factor.

5-131. Equipment.

- Voltmeter Calibrator
- BNC Cable, 44 in.

5-132. Procedure.

- Set instruments up as shown in figure 5-17.
- Set Model 1707B controls as follows:

sweep display	EXT HORIZ INPUT
SINGLE	engaged

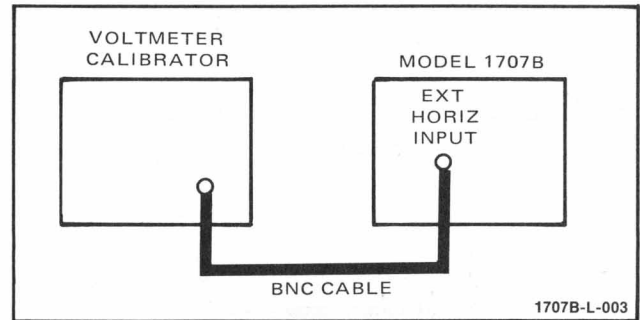


Figure 5-17. Ext Horizontal Deflection Factor Test Setup

c. Set voltmeter calibrator controls for 10V output signal.

d. In SWP MAG X1 position, horizontal deflection should be 10 div ± 0.5 div.

e. Set voltmeter calibrator output for 1V.

f. Set SWP MAG to X10. Horizontal deflection should be 10 div ± 0.5 div.

g. Rotate rear panel ext horiz VERNIER out of CAL position fully cw. Horizontal deflection should decrease to less than 1 div.

h. Return ext horiz VERNIER to CAL position.

i. Disconnect test equipment.

j. To return to initial settings, set Model 1707B controls as follows:

sweep display	MAIN SWEEP
SWP MAG	X1
SINGLE	disengaged

k. Refer to paragraph 5-215 and schematic 13 if specification is not met.

5-133. CALIBRATOR.

5-134. *Specification.* Type: 1-kHz $\pm 10\%$ square wave. Voltage: 1V p-p $\pm 1\%$.

5-135. *Description.* The frequency is checked by the Model 1707B. The calibrator amplitude is checked by comparing the calibrator amplitude against a known 0.1%, 1V p-p signal.

5-136. Equipment.

- voltmeter calibrator.
- banana jack to BNC adapter.
- BNC cable, 44 in.
- test lead.

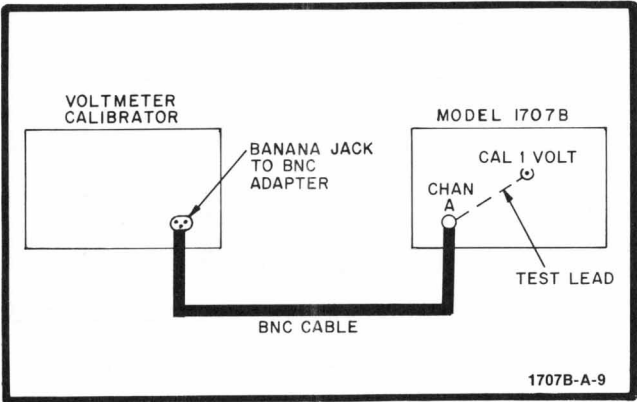


Figure 5-18. Calibrator Test Setup

5-137. Procedure.

- a. Connect instruments as shown in figure 5-18.
- b. Set Model 1707B controls as follows:

channel A VOLTS/DIV 1
channel A coupling DC
main TIME/DIV 2 mSEC

- c. Set voltmeter calibrator controls for 1V p-p output signal.
- d. Adjust channel A VOLTS/DIV vernier so display is exactly 6 div of vertical amplitude.
- e. Disconnect voltmeter calibrator.
- f. Connect CAL 1 VOLT output to channel A INPUT. Display should be 6 div of vertical amplitude $\pm .06$ div and 1 kHz $\pm 10\%$.
- g. Remove test lead.
- h. To return to initial settings, set Model 1707B controls as follows:

channel A coupling AC
channel A VOLTS/DIV 01
channel A vernier CAL
main TIME/DIV 5 uSEC
- i. Refer to paragraph 5-155 and schematic 17 if test limits are incorrect.

PERFORMANCE CHECK RECORD **MODEL 1707B**

Instrument Serial Number _____

Date _____

Check	Specification	Measured	
		Chan A	Chan B
DEFLECTION FACTOR			
.01 VOLTS/DIV	5 div ± 0.15 div	_____	_____
.02 VOLTS/DIV	5 div ± 0.15 div	_____	_____
.05 VOLTS/DIV	6 div ± 0.18 div	_____	_____
.1 VOLTS/DIV	5 div ± 0.15 div	_____	_____
.2 VOLTS/DIV	5 div ± 0.15 div	_____	_____
.5 VOLTS/DIV	6 div ± 0.18 div	_____	_____
1 VOLTS/DIV	5 div ± 0.15 div	_____	_____
2 VOLTS/DIV	5 div ± 0.15 div	_____	_____
5 VOLTS/DIV	6 div ± 0.18 div	_____	_____
Channel A Vernier	≤ 2.4 div	_____	_____
Channel B Vernier	≤ 2.4 div	_____	_____
RISE TIME			
Channel A Rise time	< 4.7 ns	_____	
Channel B Rise time	< 4.7 ns	_____	
BANDWIDTH			
Channel A Bandwidth	≥ 4.3 div	_____	
Channel B Bandwidth	≥ 4.3 div	_____	
A + B MODE	Straight line	_____	
ALT MODE	Display alternates between traces	_____	
CHOP MODE			
Slow sweep speed	Two displays	_____	
Faster sweep speed	Dashed lines	_____	
SINGLE SWEEP			
No signal	RESET indicator illuminates	_____	
Signal applied	RESET indicator extinguished and stable display	_____	

Date _____

5-18b

PERFORMANCE CHECK RECORD(Cont'd) **Model 1707B**

Instrument Serial Number _____

Date _____

Check	Specification	Measured
COMMON MODE REJECTION RATIO (CMRR)		
CMRR (50 kHz/0.01 volts/div)	<0.3 div	_____
CMRR (1 MHz/0.01 volts/div)	<0.3 div	_____
MAIN SWEEP TIME		
.1 uSEC	11 in 10 div ± 0.3 div	_____
.2 uSEC	11 in 10 div ± 0.3 div	_____
.5 uSEC	11 in 10 div ± 0.3 div	_____
1 uSEC	11 in 10 div ± 0.3 div	_____
2 uSEC	11 in 10 div ± 0.3 div	_____
5 uSEC	11 in 10 div ± 0.3 div	_____
10 uSEC	11 in 10 div ± 0.3 div	_____
20 uSEC	11 in 10 div ± 0.3 div	_____
50 uSEC	11 in 10 div ± 0.3 div	_____
.1 mSEC	11 in 10 div ± 0.3 div	_____
.2 mSEC	11 in 10 div ± 0.3 div	_____
.5 mSEC	11 in 10 div ± 0.3 div	_____
1 mSEC	11 in 10 div ± 0.3 div	_____
2 mSEC	11 in 10 div ± 0.3 div	_____
5 mSEC	11 in 10 div ± 0.3 div	_____
10 mSEC	11 in 10 div ± 0.3 div	_____
20 mSEC	11 in 10 div ± 0.3 div	_____
50 mSEC	11 in 10 div ± 0.3 div	_____
.1 SEC	11 in 10 div ± 0.3 div	_____
.2 SEC	11 in 10 div ± 0.3 div	_____
.5 SEC	11 in 10 div ± 0.3 div	_____
1 SEC	11 in 10 div ± 0.3 div	_____
2 SEC	11 in 10 div ± 0.3 div	_____
Main Vernier Check	<2 div	_____
Mag (X10) Check	10 div ± 0.5 div	_____

Instrument Serial Number _____ Date _____

5-18d

PERFORMANCE CHECK RECORD (Cont'd)
Model 1707B

Instrument Serial Number _____

Date _____

Check	Specification	Measured
MAIN TRIGGERING Internal Triggering (35 MHz) Internal Triggering (75 MHz) External Triggering (75 MHz) External Triggering (35 MHz) Chop Triggering (400 kHz)	✓ ✓ ✓ ✓ ✓	_____ _____ _____ _____ _____
DELAYED TRIGGERING Internal Triggering (35 MHz) Internal Triggering (75 MHz) External Triggering (75 MHz) External Triggering (35 MHz)	✓ ✓ ✓ ✓	_____ _____ _____ _____
MAIN TRIGGER LEVEL RANGE AND POLARITY Int Trigger Level (+) Int Trigger Level (—) Ext Trigger Level (+) Ext Trigger Level (—)	✓ ✓ —1.2V to +1.2V —1.2V to +1.2V	_____ _____ _____ _____
DELAYED TRIGGER LEVEL RANGE AND POLARITY Int Trigger Level (+) Int Trigger Level (—) Ext Trigger Level (+) Ext Trigger Level (—)	✓ ✓ —1.2V to +1.2V —1.2V to +1.2V	_____ _____ _____ _____
EXT HORIZONTAL BANDWIDTH	≤7.2 div	_____
EXT HORIZONTAL DEFLECTION FACTOR	10 div ±0.5 div	_____
CALIBRATOR Amplitude Frequency	6 div ±0.06 div 1 kHz ±10%	_____ _____

5-138. ADJUSTMENTS.

5-139. The following paragraphs describe procedures to calibrate the instrument so that it will perform as specified in table 1-1. The entire adjustment procedure can be done in sequence, or any separate adjustment can be calibrated by following the steps outlined in the appropriate paragraphs. The locations of adjustment controls are shown in figure 5-19, a photograph included at the end of this section on a foldout page.

5-140. Use a nonmetallic screwdriver and recently calibrated test equipment with characteristics as specified in table 5-1. After adjustments are complete, check instrument performance by doing the performance check at the beginning of this section.

5-141. Set Model 1707B front panel controls to those positions given in paragraph 5-10.

5-142. ADJUSTMENT PROCEDURES.**5-143. LOW VOLTAGE POWER SUPPLY ADJUSTMENT.**

5-144. *Reference.* Schematics 19, 20, 21, and figure 5-19.

5-145. *Description.* The +15V is the only regulated voltage in this instrument. The rest of the voltages in this instrument are referenced to $\pm 15V$. The voltage accuracy is set by a multifunction digital voltmeter to monitor the +15V.

5-146. *Equipment.*

- a. multifunction digital voltmeter.
- b. test lead.

5-147. *Procedure.*

- a. Remove top and bottom covers.

WARNING

Power is present in the Line Rectifier Assembly (A2) and Low Voltage Mother Board (A3A1) even when the POWER switch is off.

b. Connect multifunction digital voltmeter to TP +15V on A4 gate assembly.

c. Turn instrument power ON.

d. Adjust A3A2R3, LOW VOLTAGE ADJUST, for meter indication of $+15V \pm 10mV$.

e. Check rest of low voltage power supply output voltages as shown in table 5-5.

f. Turn instrument power off.

g. If any voltage measurement is inaccurate, refer to schematics 19, 20, and 21.

5-148. HIGH VOLTAGE POWER SUPPLY ADJUSTMENT.

5-149. *Reference.* Schematic 18 and figure 5-19.

5-150. *Description.* The high voltage is adjusted to $-2150V$ by comparing it against a known, calibrated voltage standard.

5-151. *Equipment.*

- a. multifunction digital voltmeter.
- b. voltmeter calibrator.
- c. 1000:1 divider probe.

5-152. *Procedure.*

- a. Turn instrument power off.
- b. Remove A3 power supply module cover.
- c. Turn instrument power ON.
- d. Connect multifunction digital voltmeter through 1000:1 divider probe to voltmeter calibrator.
- e. Set voltmeter calibrator to -100 -volt output.
- f. Note multifunction digital voltmeter indication.

Table 5-5. Power Supply Voltage Limits

+15V	A4 WIRE (92)	+14.99 V	+15.01 V
-15V	A4 WIRE (97)	-14.5 V	-15.75 V
+ 5V	A4 WIRE (94)	+5.1 V	+5.9 V
+50V	A4 WIRE (2)	+47 V	+52 V
-50V	A4 WIRE (7)	-47 V	-52 V
+80V	A4 WIRE (926)	+80 V	+90 V

g. Multiply indication in step f by 21.5.

h. Monitor high voltage on red wire (2) from A3A4 using 1000:1 divider probe and multifunction digital voltmeter.

i. Adjust A3A4R1, HIGH VOLTAGE ADJUST, for value calculated in step g.

j. Turn instrument power off.

k. Disconnect test equipment and replace A3 power supply module cover.

l. Check high voltage power supply circuits on schematic 18 if adjustment cannot be made.

5-153. INTENSITY LIMIT ADJUSTMENT.

5-154. *Reference.* Schematic 18 and figure 5-19.

5-155. *Description.* The intensity limit adjustment is set so the front-panel INTENSITY control has complete range. This range is from extinguished to complete brightness.

5-156. *Procedure.*

a. Turn POWER switch ON.

b. Set Model 1707B main TIME/DIV to 1 mSEC.

c. Obtain free-running trace.

d. Set INTENSITY control to 9 o'clock position.

e. Adjust A3A4R15, INTENSITY LIMIT, until trace is just extinguished.

f. Set INTENSITY control to 10 o'clock position and verify trace is visible.

g. To return to initial settings, set main TIME/DIV to 5 uSEC.

h. Check high voltage power supply circuit on schematic 18 if adjustment cannot be made.

5-157. Y-AXIS ALIGNMENT.

5-158. *Reference.* Schematic 18 and figure 5-19.

5-159. *Description.* The internal orth adjust is set to align the trace on the Y-axis.

5-160. *Equipment.*

a. oscillator.

b. BNC cable, 44 in.

NOTE

Make sure the horizontal trace is properly aligned before proceeding with this adjustment.

5-161. *Procedure.*

a. Connect oscillator to channel A INPUT.

b. Set oscillator for 10-kHz, 6-div output.

c. Set sweep display to DELAYED SWEEP (leave delayed TIME/DIV OFF).

d. Adjust HORIZONTAL POSITION until vertical line is centered on CRT screen.

e. Adjust A4R35, orth adj, until vertical line is aligned on major Y-axis graticule.

f. Disconnect oscillator.

g. To return to initial settings, set sweep display to MAIN SWEEP.

h. Refer to schematic 18 if adjustment cannot be made.

5-162. GATE AMPLIFIER RESPONSE ADJUSTMENT.

5-163. *Reference.* Schematic 17 and figure 5-19.

5-169. *Description.* The gate amplifier is adjusted for optimum response.

5-165. *Equipment.*

a. monitor oscilloscope.

b. 10:1 divider probe.

5-166. *Procedure.*

a. Set main TIME/DIV to 1 uSEC.

b. Connect 10:1 divider probe from monitor oscilloscope to wire (1) on A4 gate amplifier assembly.

c. Set monitor oscilloscope controls as follows:

coupling DC
all others normal display

d. Adjust INTENSITY control for 20V amplitude pulse as displayed on oscilloscope.

e. Adjust A4C7, gate response adj, for fastest rise time and flattest pulse of positive-going signal.

- f. Disconnect test equipment.

g. To return to initial settings, set main TIME/DIV to 5 μ SEC.

h. Refer to schematic 17 if adjustment cannot be made.

5-167. TRIGGER AMPLIFIER BALANCE AND DC ADJUSTMENT.

5-168. *Reference.* Schematics 5 and 6, and figure 5-19.

5-169. *Description.* The composite sync adj, and channel A sync adj, are set so the instrument triggers at the same point on all signals.

5-170. *Equipment.*

- a. oscillator.
- b. BNC cable, 44 in.

5-171. *Procedure.*

- a. Connect oscillator to channel A INPUT.
- b. Set channel A VOLTS/DIV to .1.
- c. Set oscillator to 50-kHz, 6-div output.
- d. Adjust channel A POSITION to center display.
- e. Adjust main TRIGGER LEVEL until sweep triggers at center graticule.
- f. Set main coupling to DC.
- g. Adjust A5A4R81, composite sync adj, until sweep triggers at same point as in step e.
- h. Set trig to A ONLY TRIG.
- i. Adjust A5A4R66, chan A sync zero, until sweep triggers at same point as in step e.
- j. Disconnect test equipment.
- k. To return to initial settings, set Model 1707B controls as follows:

trig	NORM TRIG
channel A VOLTS/DIV	.01
main coupling	AC

- l. Refer to schematics 5 and 6 if adjustment cannot be made.

5-172. TRIGGER SENSITIVITY.

5-173. *Reference.* Schematics 8 and 9, and figure 5-19.

5-174. *Description.* Trigger sensitivity is adjusted with a calibrated input to optimize triggering across the entire specified frequency range.

5-175. *Equipment.*

- a. oscillator.
- b. BNC cable, 44 in.

5-176. *Procedure.*

- a. Set Model 1707B controls as follows:

trig	A ONLY TRIG
channel A VOLTS/DIV	0.2
main TIME/DIV	.5 mSEC
main HF REJ	engaged
delayed HF REJ	engaged
AUTO/TRIG	TRIG

- b. Connect oscillator output to channel A INPUT.

c. Set oscillator controls for 500-Hz, 4-div display, output signal as viewed on Model 1707B CRT.

d. Adjust main TRIGGER LEVEL and A6A2R46, main trigger sens adj, until instrument triggers on entire range of positive slope without double triggering.

NOTE

There is a small allowable range of rotation for A6A2R46 where step d is satisfied. If optimum high frequency trigger sensitivity is desired, rotate A6A2R46 to the most counterclockwise position within the allowable range. If optimum low frequency trigger stability is desired, rotate A6A2R46 to the most clockwise position within the allowable range. The trigger sensitivity is set at the factory for optimum high frequency trigger sensitivity (farthest counterclockwise within the allowable range).

- e. Recheck performance in accordance with paragraph 5-103. Readjust A6A2R46 if necessary.

f. Set main TIME/DIV to 1 mSEC.

g. Set delayed TIME/DIV to .5 mSEC.

- h. Adjust main TRIGGER LEVEL for stable display.

- i. Set sweep display to DELAYED SWEEP.

NOTE

There is a small allowable range of rotation for A6A2R63 where step j is satisfied. If optimum high frequency trigger sensitivity is desired, rotate A6A2R63 to the most clockwise position within the allowable range. If optimum low frequency trigger stability is desired, rotate A6A2R63 to the most counterclockwise position within the allowable range. The trigger sensitivity is set at the factory for optimum high frequency trigger sensitivity (farthest clockwise within allowable range).

j. Adjust delayed TRIGGER LEVEL and A6A2R63, delayed trigger sens adj, until instrument triggers across entire range of positive slope without double triggering.

k. Recheck performance in accordance with paragraph 5-108. Readjust A6A2R63 as necessary.

l. Disconnect test equipment.

m. To return to initial settings, set Model 1707B controls as follows:

delayed TIME/DIV	OFF
main TIME/DIV	5 uSEC
AUTO/TRIG	AUTO
sweep display	MAIN SWEEP
channel A VOLTS/DIV	.01
trig	NORM TRIG
main HF REJ	disengaged
delayed HF REJ	disengaged

n. Refer to schematics 8 and 9 if adjustment cannot be made.

5-177. POSITION CENTERING ADJUSTMENT.

5-178. *Reference.* Schematics 4 through 7 and figure 5-19.

5-179. *Description.* Internal controls are adjusted to center the display. This adjustment varies the amplifier dc reference, thus establishing position.

5-180. *Procedure.*

a. Set DISPLAY to B.

b. Center channel B POSITION control.

c. Adjust front panel DC BAL for no vertical trace shift as B POLARITY switch is changed from NORM to INVT.

d. Adjust A5A4R92, position center, to center trace vertically.

e. Adjust A5A4R46, chan B internal DC bal, for no vertical trace shift as channel B vernier is rotated.

f. Repeat steps b through e, if necessary, until there is no further change.

g. Set DISPLAY to A.

h. Center channel A POSITION control.

i. Adjust front-panel DC BAL to center trace.

j. Adjust A5A4R43, channel A internal DC bal, for no vertical trace shift as channel A vernier is rotated.

k. Repeat steps h through j, if necessary, until there is no further change.

l. Set DISPLAY to A+B.

m. Adjust A5A4R70, A+B bal, to center trace.

n. To return to initial settings, set DISPLAY to A.

o. Refer to schematics 4, 5, 6 and 7 if adjustment cannot be made.

5-181. SWEEP LENGTH ADJUSTMENT.

5-182. *Reference.* Schematic 16 and figure 5-19.

5-183. *Description.* The horizontal preamplifier X1 gain adjust is set to calibrate the 1.00 and 9.00 positions on the DELAY TIME dial.

5-184. *Procedure.*

a. Set Model 1707B controls as follows:

channel A VOLTS/DIV	approx 5 div
	of deflection
main TIME/DIV	1 mSEC
delayed TIME/DIV	1 uSEC

b. Adjust INTENSITY so bright dot is visible on trace.

c. Set DELAY TIME to 1.00.

d. Adjust HORIZONTAL POSITION until bright dot is on second vertical graticule line from left.

e. Set DELAY TIME to 9.00.

f. Adjust A6A9R1, X1 gain adj, until bright dot is on 10th vertical graticule line from left.

g. Repeat steps c through f until bright dots are exactly eight divisions apart when DELAY TIME is moved from 1.00 to 9.00.

h. To return to initial settings, set Model 1707B controls as follows:

channel A VOLTS/DIV 01
main TIME/DIV 5 uSEC
delayed TIME/DIV OFF
DELAY TIME 0.00

i. Refer to schematic 16 if adjustment cannot be made.

5-185. MAIN SWEEP TIMING ADJUSTMENT.

5-186. *Reference.* Schematics 10 and 11 and figure 5-19.

5-187. *Description.* The main sweep time adjustments are made with a known time reference input to provide a calibrated sweep.

5-188. *Equipment.*

- a. time-mark generator.
- b. BNC cable, 44 in.

5-189. *Procedure.*

a. Connect time-mark generator to channel A INPUT.

b. Set Model 1707B controls as follows:

channel A VOLTS/DIV approx 5 div
of deflection
main TIME/DIV 1 uSEC
delayed TIME/DIV 1 uSEC

c. Set time-mark generator 1-usec time-mark output.

d. Adjust DELAY TIME to intensify second time mark from left.

e. Set sweep display to DELAYED SWEEP.

f. Adjust DELAY TIME to place time mark on center vertical graticule line. Note DELAY TIME setting.

DELAY TIME _____

g. Set sweep display to MAIN SWEEP.

h. Advance DELAY TIME to intensify 10th marker from left.

i. Set sweep display to DELAYED SWEEP.

j. Set DELAY TIME to 8.00 above dial setting noted in step f.

k. Adjust A6A5R16 to align 10th time mark with center vertical graticule line.

l. Repeat steps d through k until no further adjustment is required as DELAY TIME is varied to intensify second time mark and 10th time mark.

m. Make main sweep time adjustments in table 5-6 using procedures in steps b through l.

n. Disconnect test equipment.

o. To return to initial settings, set Model 1707B controls as follows:

channel A VOLTS/DIV 01
main TIME/DIV 5 uSEC
delayed TIME/DIV OFF
DELAY TIME 0.00
sweep display MAIN SWEEP

5-190. DELAYED SWEEP TIME ADJUSTMENT.

5-191. *Reference.* Schematics 12 and 13, and figure 5-19.

5-192. *Description.* The delayed sweep time adjustments are made with a known time reference input to provide a calibrated sweep.

5-193. *Equipment.*

- a. time-marker generator.
- b. BNC cable, 44 in.

Table 5-6. Main Time Adjustments

Time-mark Generator	Main TIME/DIV	Adjustment
1 usec	1 uSEC	A6A6R16
.1 msec	.1 mSEC	A6A6R15
5 msec	5 mSEC	A6A6R14
.1 sec	.1 SEC	A6A6R13

A6

A6A5

5-194. Procedure.

a. Connect time-mark generator output to channel A INPUT.

b. Set Model 1707B controls as follows:

channel A VOLTS/DIV approx 5 div
of deflection
main TIME/DIV 2 uSEC
delayed TIME/DIV 1 uSEC
sweep display DELAYED SWEEP

c. Set time-mark generator for 0.1-use time-mark output.

d. Adjust A6A6R16 for 11 marks in 10 divisions.

e. Complete rest of sweep time adjustments per table 5-7. Main TIME/DIV control should be one step slower than delayed TIME/DIV.

f. Disconnect test equipment.

g. To return to initial settings, set Model 1707B controls as follows:

channel A VOLTS/DIV 01
main TIME/DIV 5 uSEC
delayed TIME/DIV OFF
sweep display MAIN SWEEP

h. Refer to schematics 12 and 13 if this adjustment cannot be made.

5-195. X10 GAIN ADJUSTMENT.

5-196. Reference. Schematic 16 and figure 5-19.

5-197. Description. The horizontal preamplifier circuit X10 gain adjust is adjusted in the expand mode for X10 magnification.

5-198. Equipment

- a. time-mark generator.
- b. BNC cable, 44 in.

5-199. Procedure.

a. Connect time-mark generator to channel A INPUT.

b. Set Model 1707B controls as follows:

main TIME/DIV 1 mSEC
channel A VOLTS/DIV approx 5 div
of deflection

c. Set time-mark generator controls for 0.1-ms time marks.

d. Set SWP MAG to X10.

e. Adjust A6A9R21, X10 gain adj, for 1 div between time marks.

f. Disconnect test equipment.

g. To return to initial settings, set Model 1707B controls as follows:

SWP MAG X1
channel A VOLTS/DIV 01
main TIME/DIV 5 uSEC

h. Refer to schematic 16 if adjustment cannot be made.

5-200. MAG CENTERING ADJUSTMENT.

5-201. Reference. Schematic 16 and figure 5-19.

5-202. Description. The mag centering adj is set so the display is expanded around center screen.

5-203. Equipment.

- a. Time-mark generator.
- b. BNC cable, 44 in.

5-204. Procedure.

a. Connect time-mark generator to channel A INPUT.

Table 5-7. Delayed Sweep Time Adjustments

Time-mark Generator	Delayed TIME/DIV	Adjustment	Time mark
0.1 usec	.1 uSEC	A6A6R16	11 in 10 div
1 usec	1 uSEC	A6A6R15	
1 ms	1 mSEC	A6A6R14	
10 ms	10 mSEC	A6A6R13	

- b. Set Model 1707B controls as follows:

main TIME/DIV 2 mSEC
channel A VOLTS/DIV approx 5 div
of deflection

- c. Set time-mark generator controls for 1-ms time-mark output.

- d. Adjust HORIZONTAL POSITION so middle time mark is on center graticule.

- e. Set SWP MAG to X10.

- f. Adjust A6A9R2, mag centering adj, to re-center middle time-mark.

- g. Disconnect test equipment.

- h. To return to initial settings, set Model 1707B controls as follows:

channel A VOLTS/DIV 01
main TIME/DIV 5 uSEC
SWP MAG X1

- i. Refer to schematic 16 if adjustment cannot be made.

5-205. CALIBRATOR ADJUSTMENT.

5-206. *Reference.* Schematic 17 and figure 5-19.

5-207. *Description.* The calibrator output is compared against a voltmeter calibrator standard to accurately set the calibrator amplitude.

5-208. *Equipment.*

- a. voltmeter calibrator.
- b. test leads.

5-209. *Procedure.*

- a. Set channel A VOLTS/DIV to .1.
- b. Set channel A coupling to DC.
- c. Connect voltmeter calibrator to channel A INPUT.
- d. Set voltmeter calibrator to 1V p-p output.
- e. Adjust channel A vernier for display of 6 div.
- f. Disconnect voltmeter calibrator.
- g. Connect CAL 1 VOLT output to channel A INPUT.

- h. Adjust A4R29, cal ampl adj, for 6-div display.

- i. Disconnect CAL 1 VOLT output from channel A.

- j. To return to initial settings, set Model 1707B controls as follows:

channel A VOLTS/DIV 01
channel A vernier CAL detent
channel A coupling AC

- k. Refer to schematic 17 if adjustment cannot be made.

5-210. EXT HORIZ INPUT COMPENSATION.

5-211. *Reference.* Schematic 15 and figure 5-19.

5-212. *Description.* A square-wave generator is used to adjust input compensation. A 5V, 1-kHz signal from the square-wave generator is applied to EXT HORIZ INPUT and input comp, A8C1, is adjusted for minimum overshoot and undershoot.

5-213. *Equipment.*

- a. square-wave generator.
- b. BNC cable, 44 in.

5-214. *Procedure.*

- a. Connect square-wave generator output to EXT HORIZ INPUT.

- b. Set Model 1707B controls as follows:

sweep display EXT HORIZ INPUT
ext horiz VERNIER CAL
SINGLE engaged

- c. Set square-wave generator controls for 5V, 1-kHz output signal.

- d. Adjust A8C1, input comp, for minimum overshoot or undershoot.

NOTE

Overshoot is characterized by a dim extension of the trace on the right side of CRT. Undershoot is characterized by an intensified portion of the trace on the right side of CRT. The best adjustment of A8C1 is when the intensified portion of the trace and the dim extension of the trace have disappeared.

- e. Remove test equipment.

f. To return to initial settings, set Model 1707B controls as follows:

sweep display MAIN SWEEP
SINGLE disengaged

g. Refer to schematic 15 if adjustment cannot be made.

5-215. EXT HORIZ GAIN ADJUST.

5-216. *Reference.* Schematic 15 and figure 5-19.

5-217. *Description.* The gain of the external horizontal amplifier is set by applying a 10V, 400-Hz signal from a voltmeter calibrator and adjusting horiz gain, A8R15, for exactly 10 div of horizontal deflection.

5-218. *Equipment.*

- a. voltmeter calibrator.
- b. BNC cable, 44 in.

5-219. *Procedure.*

a. Connect voltmeter calibrator output to EXT HORIZ INPUT.

b. Set Model 1707B controls as follows:

sweep display EXT HORIZ INPUT
SINGLE engaged

c. Set voltmeter calibrator controls for 10V output signal.

d. Adjust A8R15, horiz gain, to obtain exactly 10 div of horizontal deflection.

e. Disconnect test equipment.

f. To return to initial settings, set Model 1707B controls as follows:

sweep display MAIN SWEEP
SINGLE disengaged

g. Refer to schematic 15 if adjustment cannot be made.

5-220. LOW-FREQUENCY PULSE RESPONSE ADJ.

5-221. *Reference.* Schematic 6 and figure 5-19.

5-222. *Description.* The low frequency compensation resistor in the vertical preamplifier is adjusted for optimum pulse response.

5-223. *Equipment.*

- a. square-wave generator.
- b. 50-ohm feedthrough termination.
- c. BNC cable, 44 in.

5-224. *Procedure.*

a. Connect output of square-wave generator through 50-ohm termination to channel A INPUT.

b. Set Model 1707B controls as follows:

channel A VOLTS/DIV 1
main TIME/DIV to display approximately 2 pulses

c. Adjust square-wave generator output for 6-division, 50-kHz display.

d. Adjust A5A4R96, LF comp adj, for flattest pulse response.

e. Disconnect test equipment.

f. To return to initial settings, set Model 1707B controls as follows:

main TIME/DIV 5 uSEC
channel A VOLTS/DIV 01

g. Refer to schematic 6 if adjustment cannot be made.

5-225. INPUT CAPACITANCE AND ATTENUATOR COMPENSATION ADJUSTMENT.

5-226. *Reference.* Schematic 3 and figure 5-19.

5-227. *Description.* The input capacitance is adjusted to make the capacitance the same on all ranges. The attenuator compensation adjustment is made with a square wave input to provide optimum square wave response.

5-228. *Equipment.*

- a. LC meter.
- b. square-wave generator.
- c. BNC cable, 44 in.

5-229. *Procedure.*

a. Connect 600-ohm output from square-wave generator to both channels A and B INPUT.

- b. Set Model 1707B controls as follows:

DISPLAY ALT
VOLTS/DIV (both channels) 02
main TIME/DIV 20 mSEC
coupling (channel A and B) DC

- c. Set square-wave generator for 10-kHz, 4-division display.

- d. Perform adjustments in table 5-8 for best square-wave response.

- e. Disconnect square-wave generator.

Table 5-8. Square-wave Adjustment

VOLTS/DIV	Channel A	Channel B
.02	A5A1C18	A5A2C18
.05	A5A1C19	A5A2C19
.1	A5A1C8	A5A2C8
.2	A5A1C13	A5A2C13
.5	A5A1C14	A5A2C14
1	A5A1C9	A5A2C9

- f. Connect LC meter to appropriate channel as listed in table 5-9 and measure input capacitance on .01 VOLTS/DIV range. Adjust appropriate capacitor to obtain same input capacitance as measured on .01 VOLTS/DIV range.

Table 5-9. Capacitance Adjustment

VOLTS/DIV	Channel A	Channel B
.01	REFERENCE	REFEREMCE
.1	A5A1C4	A5A2C4
1	A5A1C5	A5A2C5

- g. Disconnect test equipment.

- h. To return to initial settings, set Model 1707B controls as follows:

VOLTS/DIV (channel A and B) 01
DISPLAY A
main TIME/DIV 5 uSEC
coupling (channel A and B) AC

- i. Refer to schematics 3 and 4 if adjustments cannot be made.

5-230. HIGH-FREQUENCY PULSE RESPONSE ADJ.

- 5-231. *Reference.* Schematics 4 and 6, and figure 5-19.

- 5-232. *Description.* The high frequency compensation capacitors in the vertical amplifiers are adjusted for optimum pulse response.

5-233. Equipment.

- square-wave generator.
- 50-ohm feedthrough termination.
- RG 213 cable.

5-234. Procedure.

- Connect output of square-wave generator through 50-ohm termination to channel B INPUT.

- Set Model 1707B controls as follows:

DISPLAY B
main TIME/DIV 1 uSEC
SWP MAG X10

- Adjust square-wave generator output for 6-division, 100-kHz display.

- Adjust A5A4C26, A5A4C46, A5A5C7, A5A5C12, and A5A5R30 for best pulse response with rise time of less than 4.7 ns.

- Observe pulse response of channel B in NORM and INVT positions.

- Readjust A5A4C26, if necessary, to obtain optimum pulse response for both positions with rise-time of less than 4.7 ns.

- Connect square-wave generator to channel A INPUT.

- Set DISPLAY to A.

- Adjust A5A4C25, chan A HF adj, for best pulse response with rise time of less than 4.7 ns.

- Repeat steps b through f for optimum pulse response on both channels.

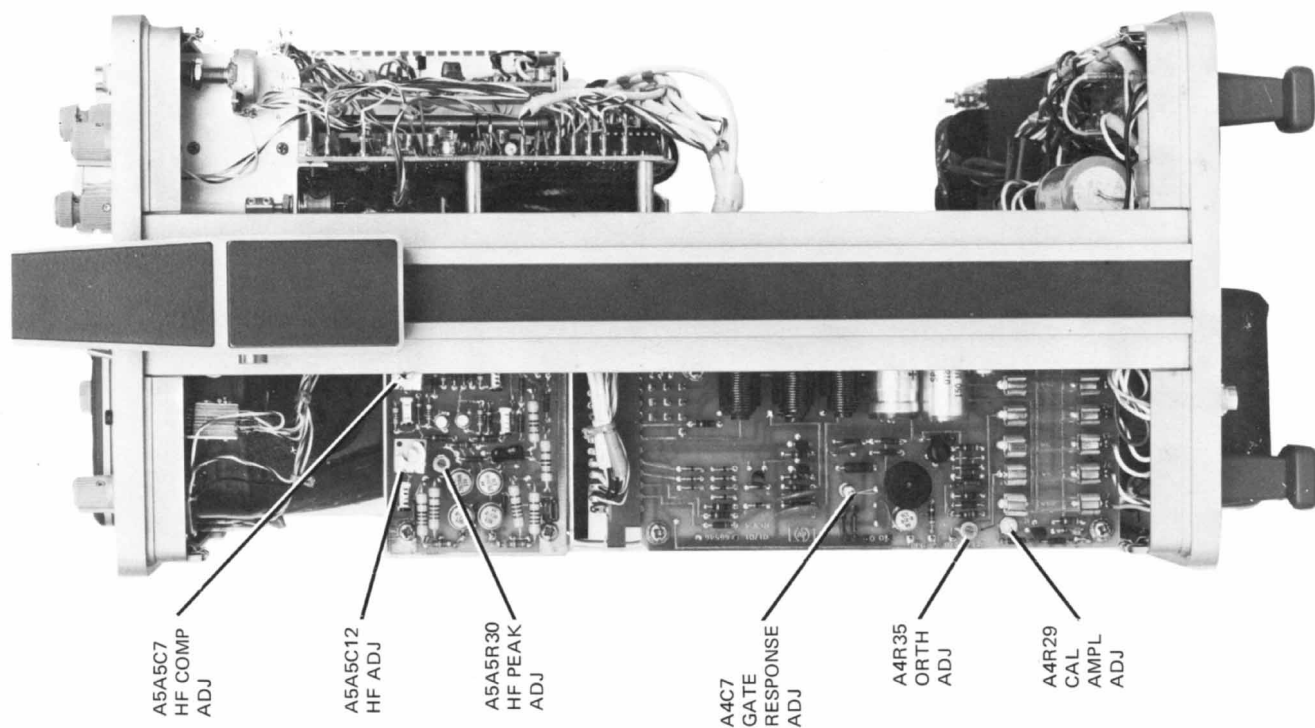
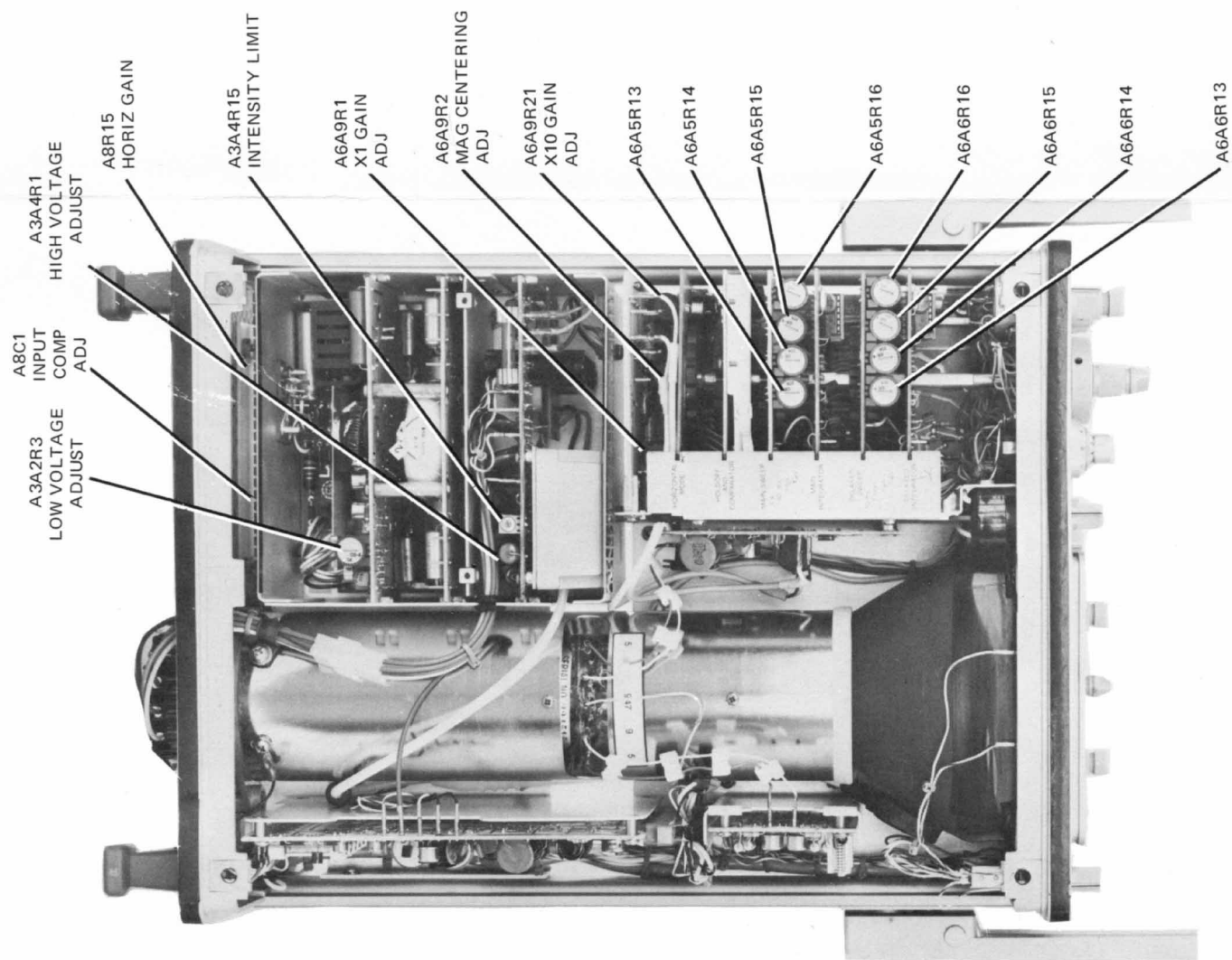
- Disconnect test equipment.

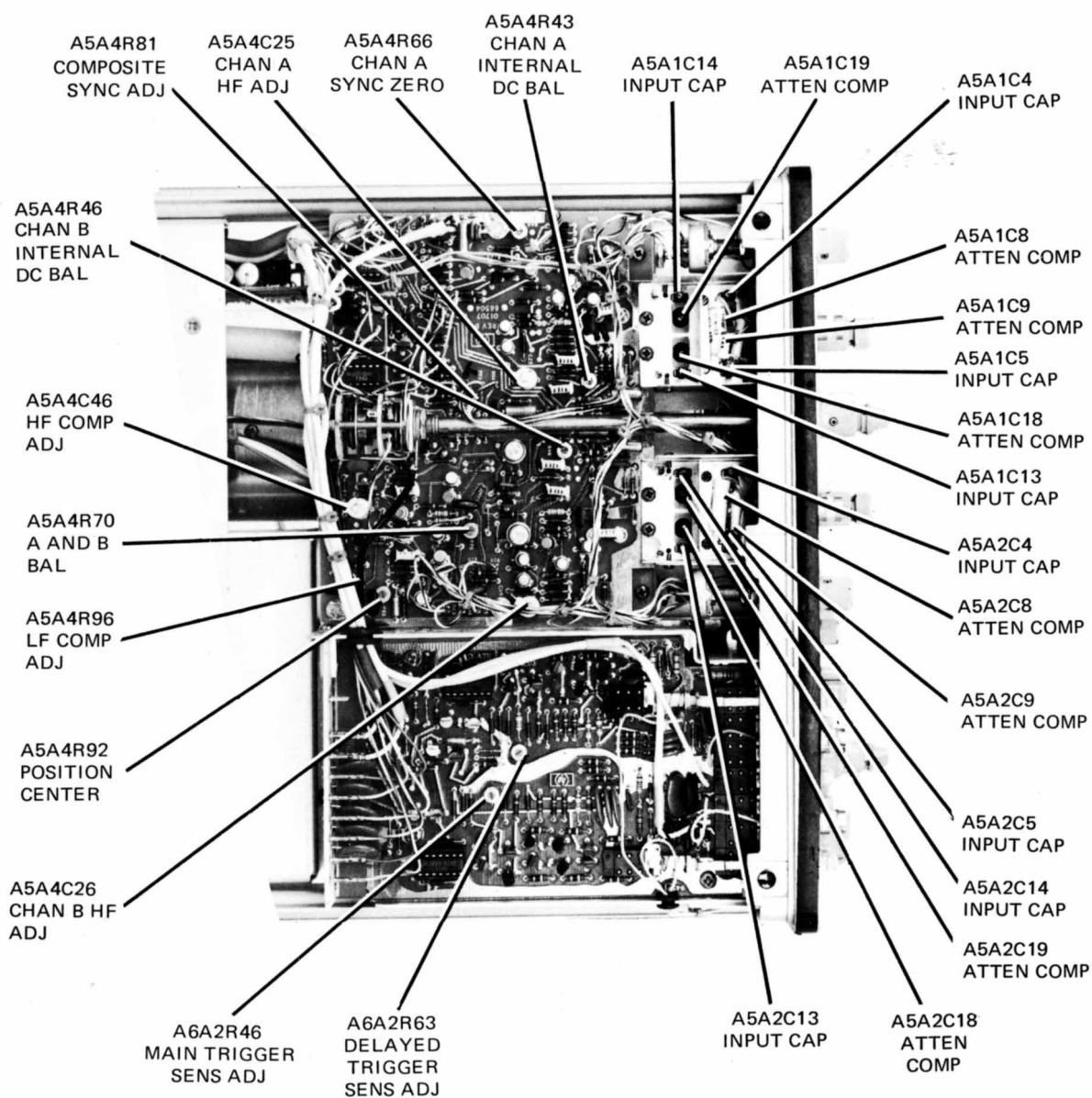
- To return to initial settings, set Model 1707B controls as follows:

main TIME/DIV 5 uSEC
B POLARITY NORM
SWP MAG X1

- Perform paragraph 5-23, bandwidth check, to ensure 75-MHz bandwidth is met.

- Refer to schematics 4 and 6 if adjustment cannot be made.





1707B-R-9A

Figure 5-19
Adjustment Locations
5-29/(5-30 blank)

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. The abbreviations used in the parts list are described in table 6-1. Table 6-2 lists the parts in alphanumeric order by reference designation and includes the manufacturer and manufacturer's part number. Table 6-3 contains the list of manufacturers' codes.

6-3. ORDERING INFORMATION.

6-4. To obtain replacement parts from Hewlett-Packard, address order or inquiry to the nearest Hewlett-Packard Sales/Service Office and supply the following information:

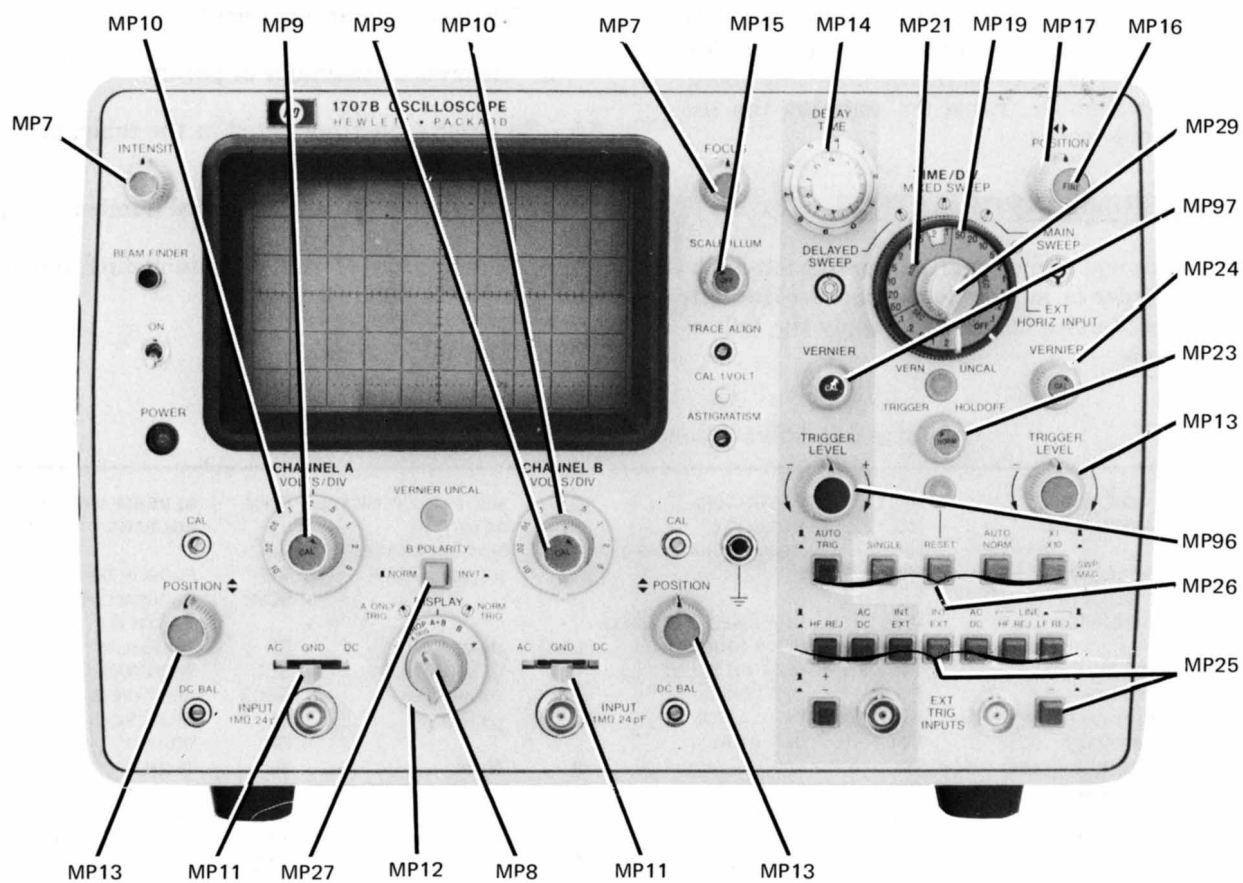
- a. Instrument model and serial number.
- b. HP part number of item(s).
- c. Quantity of part(s) desired.
- d. Reference designator of part(s).

6-5. To order a part not listed in the table, provide the following information:

- a. Instrument model and serial number.
- b. Description of the part, including function and location in the instrument.
- c. Quantity desired.

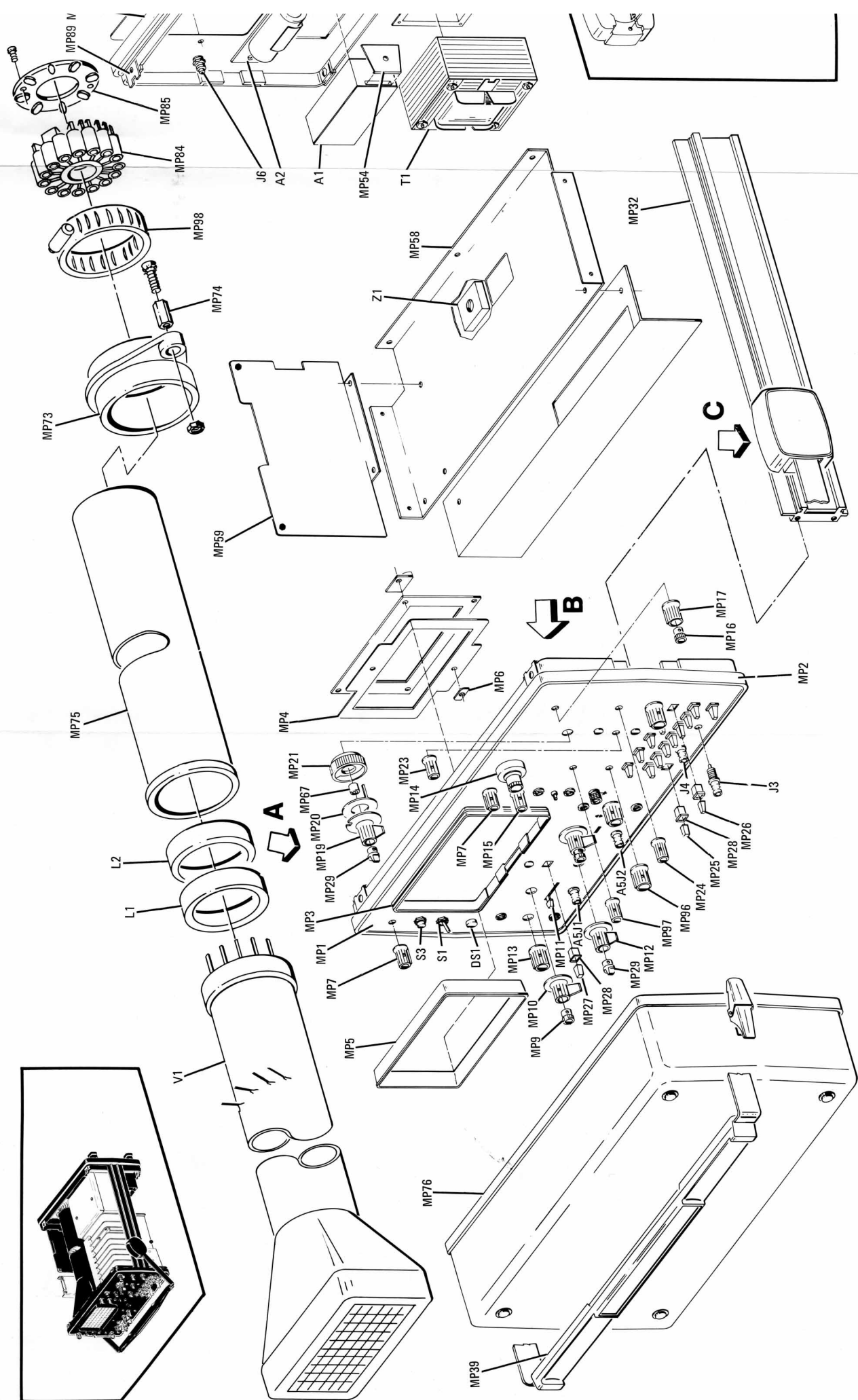
Table 6-1. Abbreviations for Replaceable Parts List

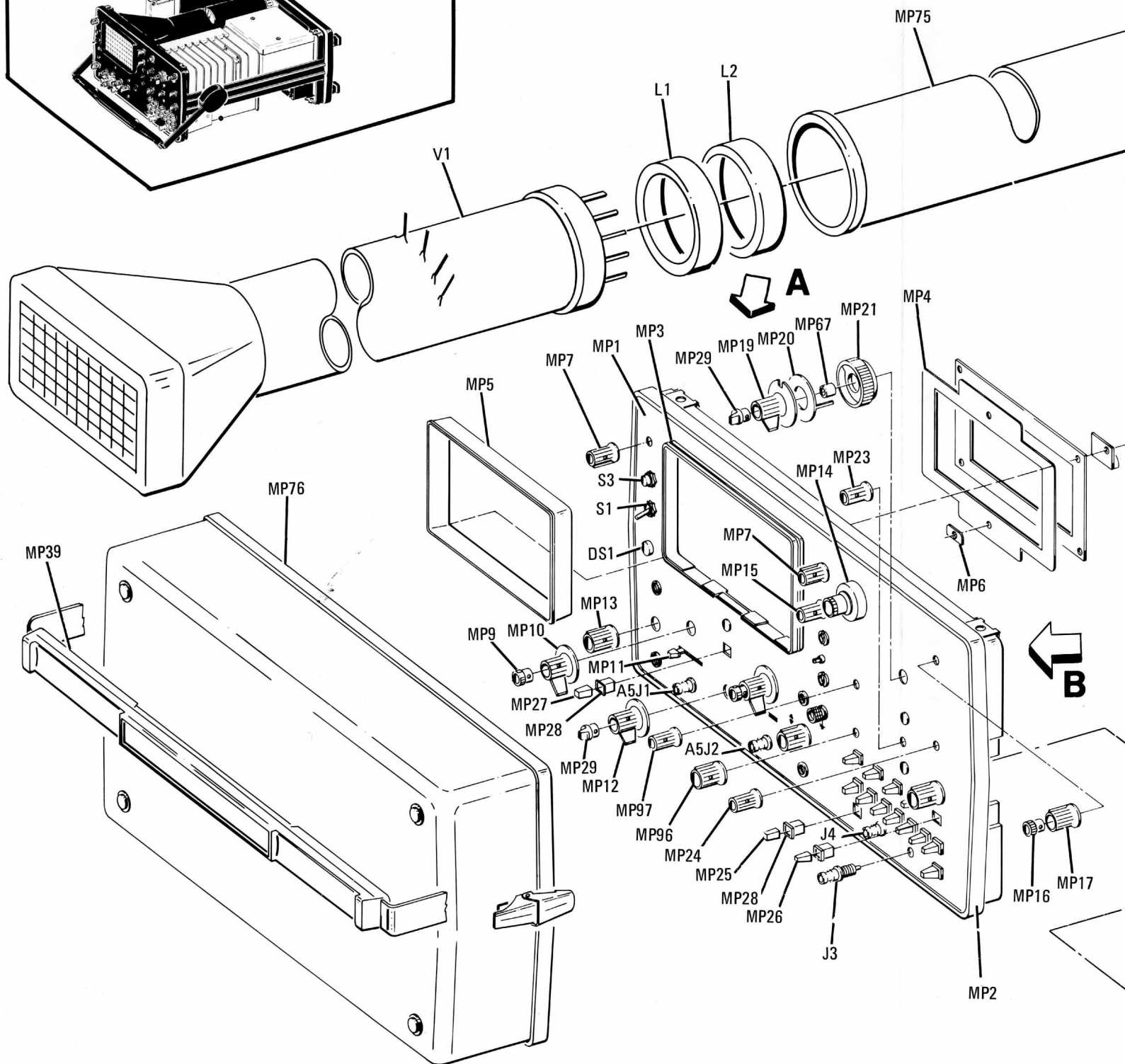
A	AMPERE(S)	H	HENRY(IES)	NPN	NEGATIVE-POSITIVE-	RWV	REVERSE WORKING
ASSY	ASSEMBLY	HG	MERCURY		NEGATIVE		VOLTAGE
BD	BOARD(S)	HP	HEWLETT-PACKARD	NSR	NOT SEPARATELY		
BH	BINDER HEAD	HZ	HERTZ		REPLACEABLE	S-B	SLOW-BLOW
BP	BANDPASS					SCR	SILICON CONTROLLED
		IF	INTERMEDIATE FREQ.				RECTIFIER
C	CENTI (10 ⁻²)	IMPG	IMPREGNATED	OBD	ORDER BY	SE	SELENIUM
CAR	CARBON	INCD	INCANDESCENT		DESCRIPTION	SEC	SECOND(S)
CCW	COUNTERCLOCKWISE	INCL	INCLUDE(S)	OH	OVAL HEAD	SECT	SECTION(S)
CER	CERAMIC	INS	INSULATION(ED)	OX	OXIDE	SI	SILICON
CMO	CABINET MOUNT ONLY	INT	INTERNAL			SIL	SILVER
COAX	COAXIAL			P	PEAK	SL	SLIDE
COEF	COEFFICIENT	K	KILO (10 ³)	PC	PRINTED (ETCHED)	SP	SINGLE POLE
COMP	COMPOSITION	KG	KILOGRAM		CIRCUIT(S)	SPL	SPECIAL
CONN	CONNECTOR(S)			PF	PICOFARADS	ST	SINGLE THROW
CRT	CATHODE-RAY TUBE	LB	POUND(S)	PHL	PHILLIPS	STD	STANDARD
CW	CLOCKWISE	LH	LEFT HAND	PIV	PEAK INVERSE		
		LIN	LINEAR TAPER		VOLTAGE(S)	TA	TANTALUM
D	DECI (10 ⁻¹)	LOG	LOGARITHMIC TAPER	PNP	POSITIVE-NEGATIVE-	TD	TIME DELAY
DEPC	DEPOSITED CARBON	LPF	LOW-PASS FILTER(S)		POSITIVE	TFL	TEFLON
DP	DOUBLE POLE	LVR	LEVER	P/O	PART OF	TGL	TOGGLE
DT	DOUBLE THROW			PORC	PORCELAIN	THYR	THYRISTOR
		M	MILLI (10 ⁻³)	POS	POSITION(S)	TI	TITANIUM
ELECT	ELECTROLYTIC	MEG	MEGA (10 ⁶)	POT	POTENTIOMETER(S)	TNLDIO	TUNNEL DIODE(S)
ENCAP	ENCAPSULATED	MET FILM	METAL FILM	P-P	PEAK-TO-PEAK	TOL	TOLERANCE
EXT	EXTERNAL	MET OX	METAL OXIDE	PRGM	PROGRAM	TRIM	TRIMMER
		MFR	MANUFACTURER	PS	POLYSTYRENE		
F	FARAD(S)	MINAT	MINIATURE	PWV	PEAK WORKING	U	MICRO (10 ⁻⁶)
FET	FIELD-EFFECT	MOM	MOMENTARY		VOLTAGE		
	TRANSISTOR(S)	MTG	MOUNTING	RECT	RECTIFIER(S)	V	VOLTS
FH	FLAT HEAD	MY	MYLAR	RF	RADIO FREQUENCY	VAR	VARIABLE
FIL H	FILLISTER HEAD			RFI	RADIO FREQUENCY	VDCW	DC WORKING VOLT(S)
FXD	FIXED	N	NANO (10 ⁻⁹)		INTERFERENCE	W	WATT(S)
		N/C	NORMALLY CLOSED			W/	WITH
G	GIGA (10 ⁹)	NE	NEON	RH	ROUND HEAD	WIV	WORKING INVERSE
GE	GERMANIUM	N/O	NORMALLY OPEN		OR		VOLTAGE
GL	GLASS	NOP	NEGATIVE POSITIVE	RMO	RACK MOUNT ONLY	W/O	WITHOUT
GRD	GROUNDED		ZERO (ZERO TEMPER- ATURE COEFFICIENT)	RMS	ROOT MEAN SQUARE	WW	WIREWOUND

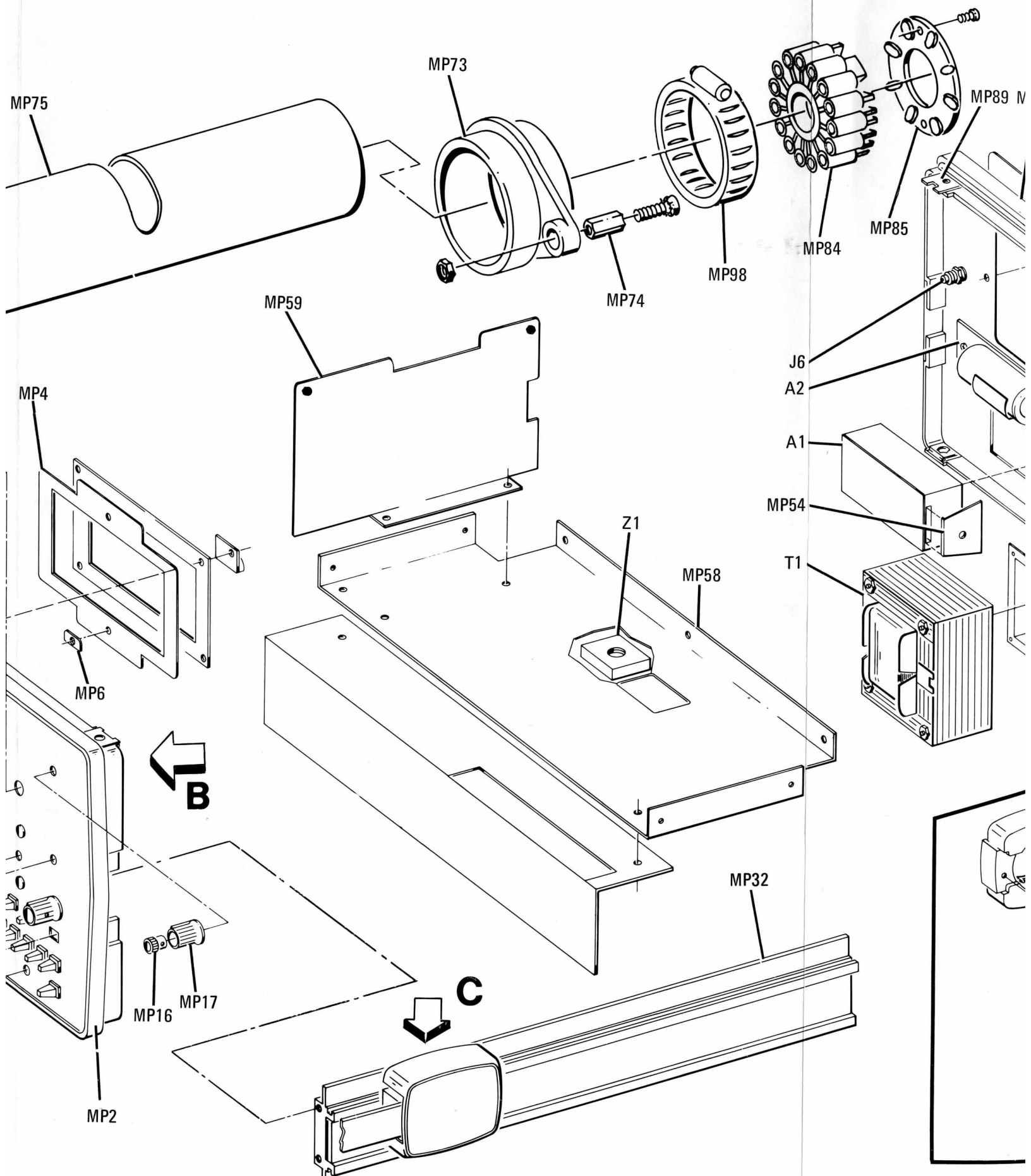


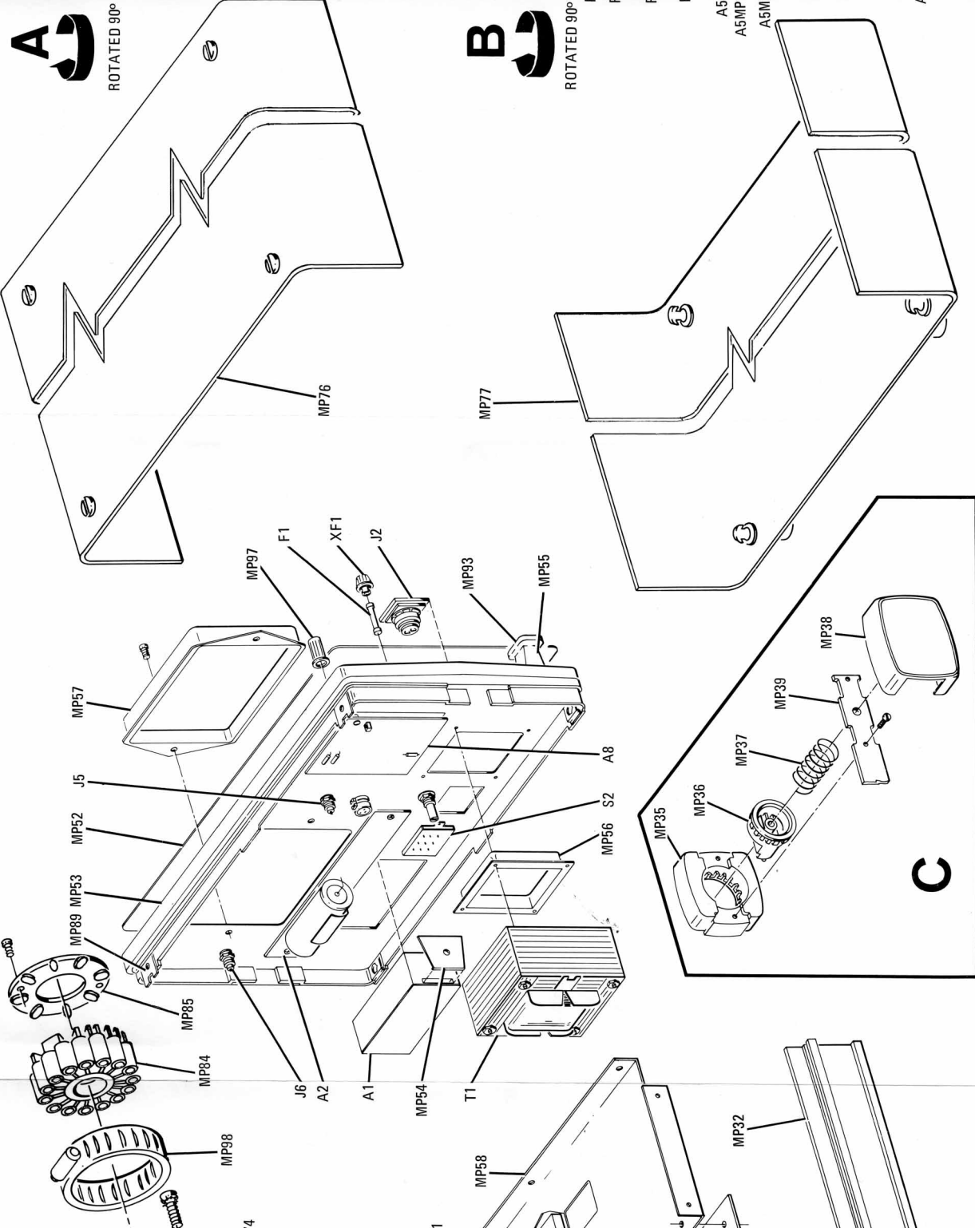
1707B-R-12A

Figure 6-1. Knob Locator



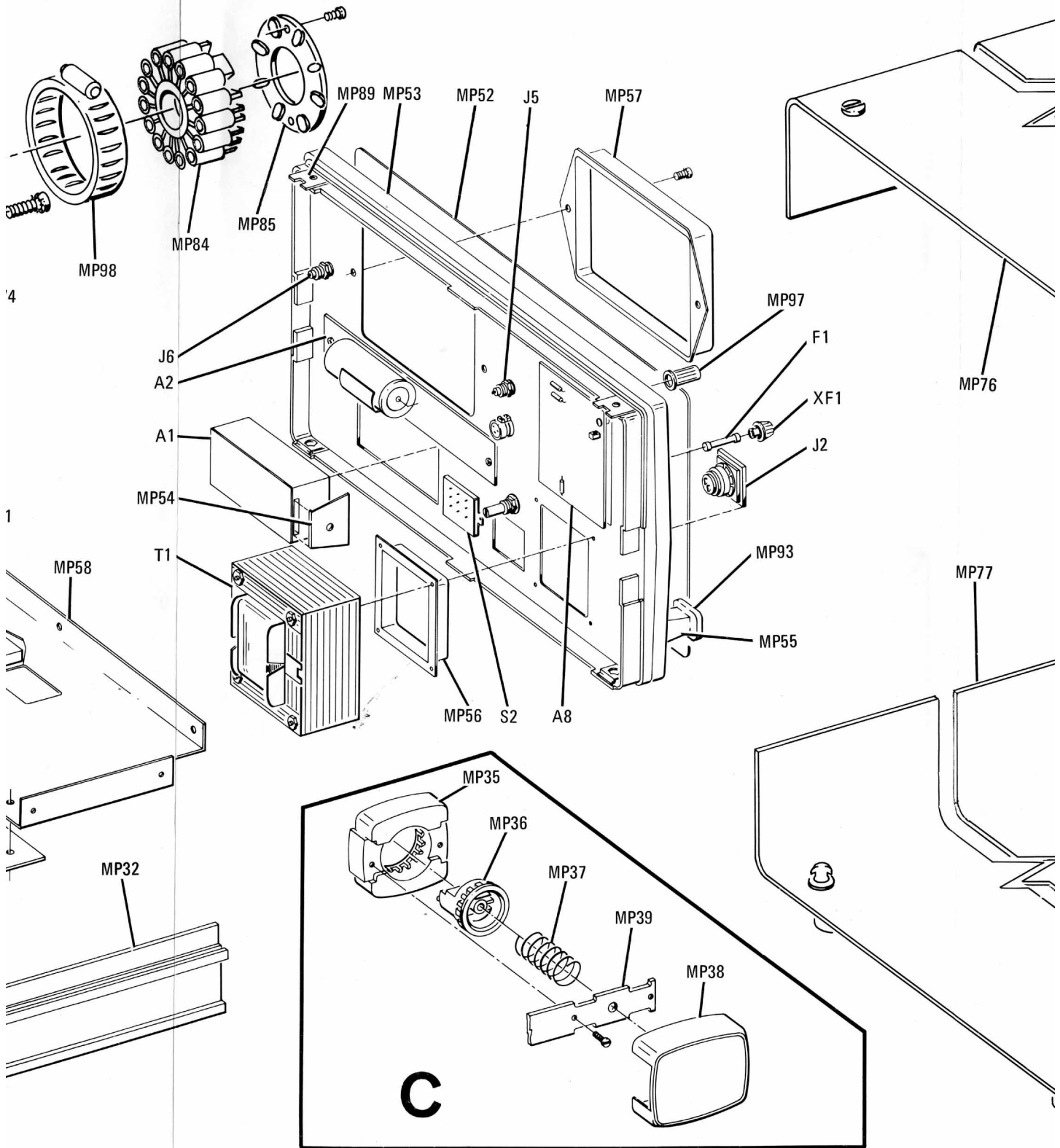


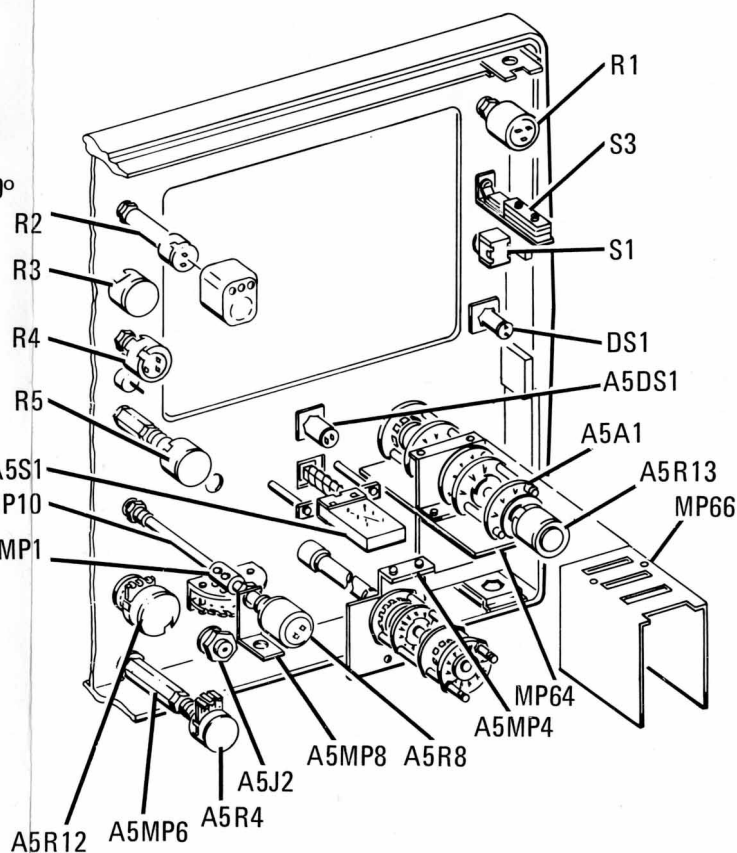
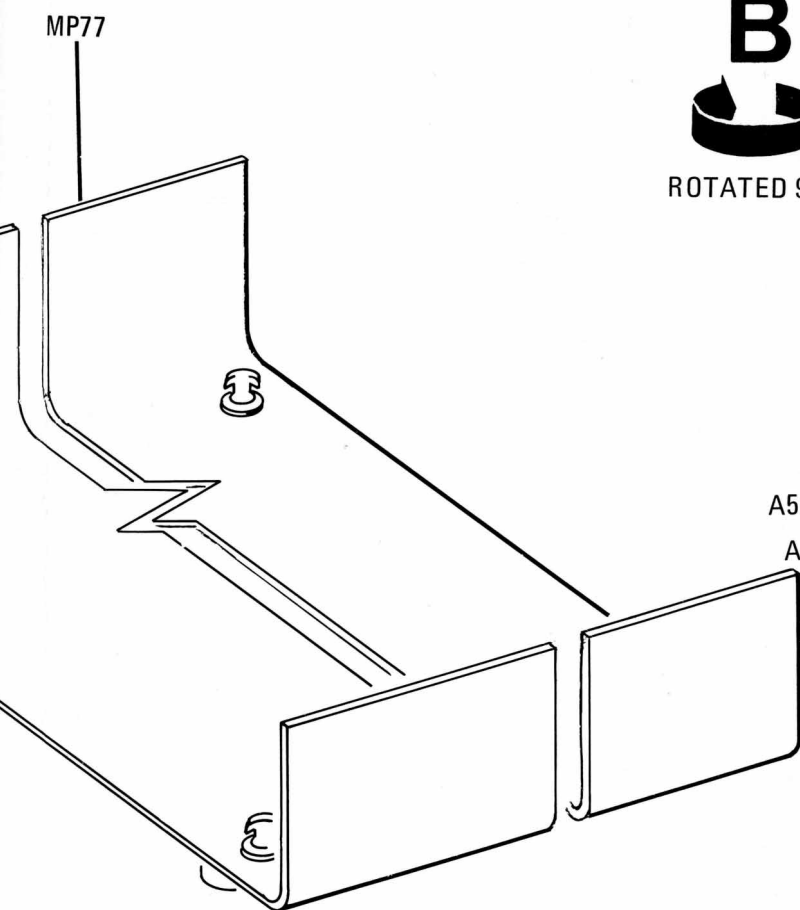
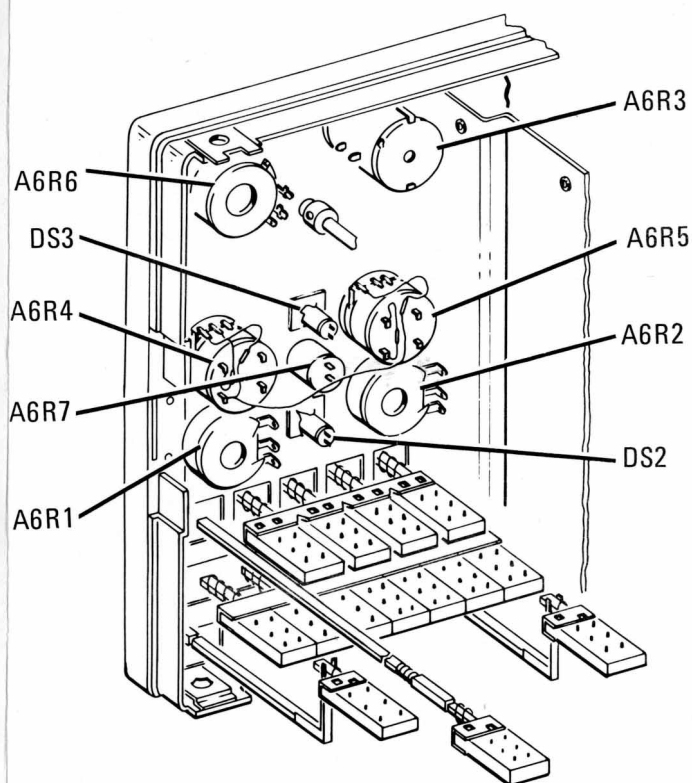
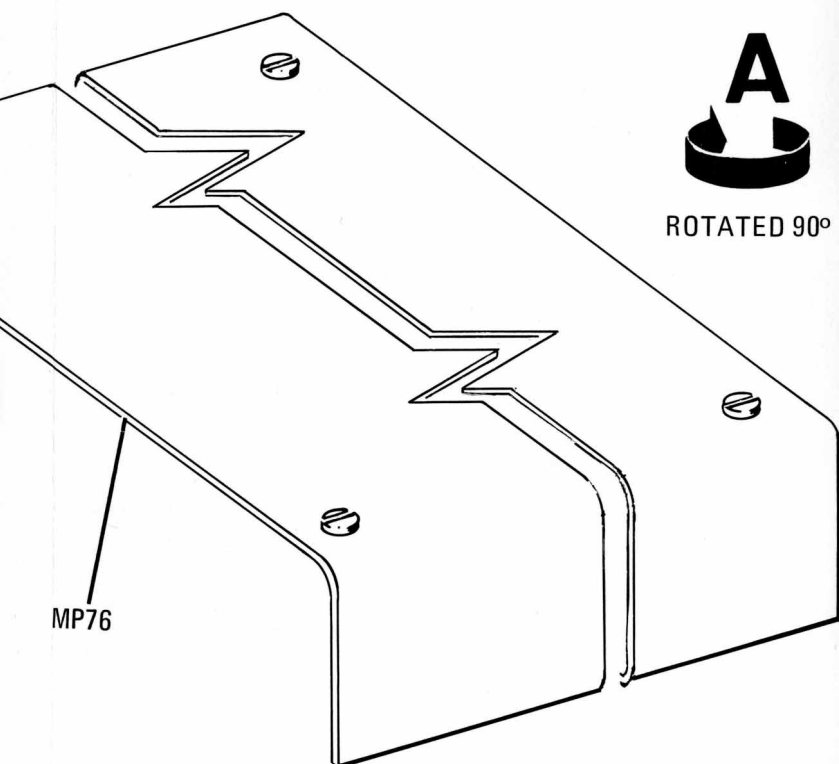




1707B-L-004

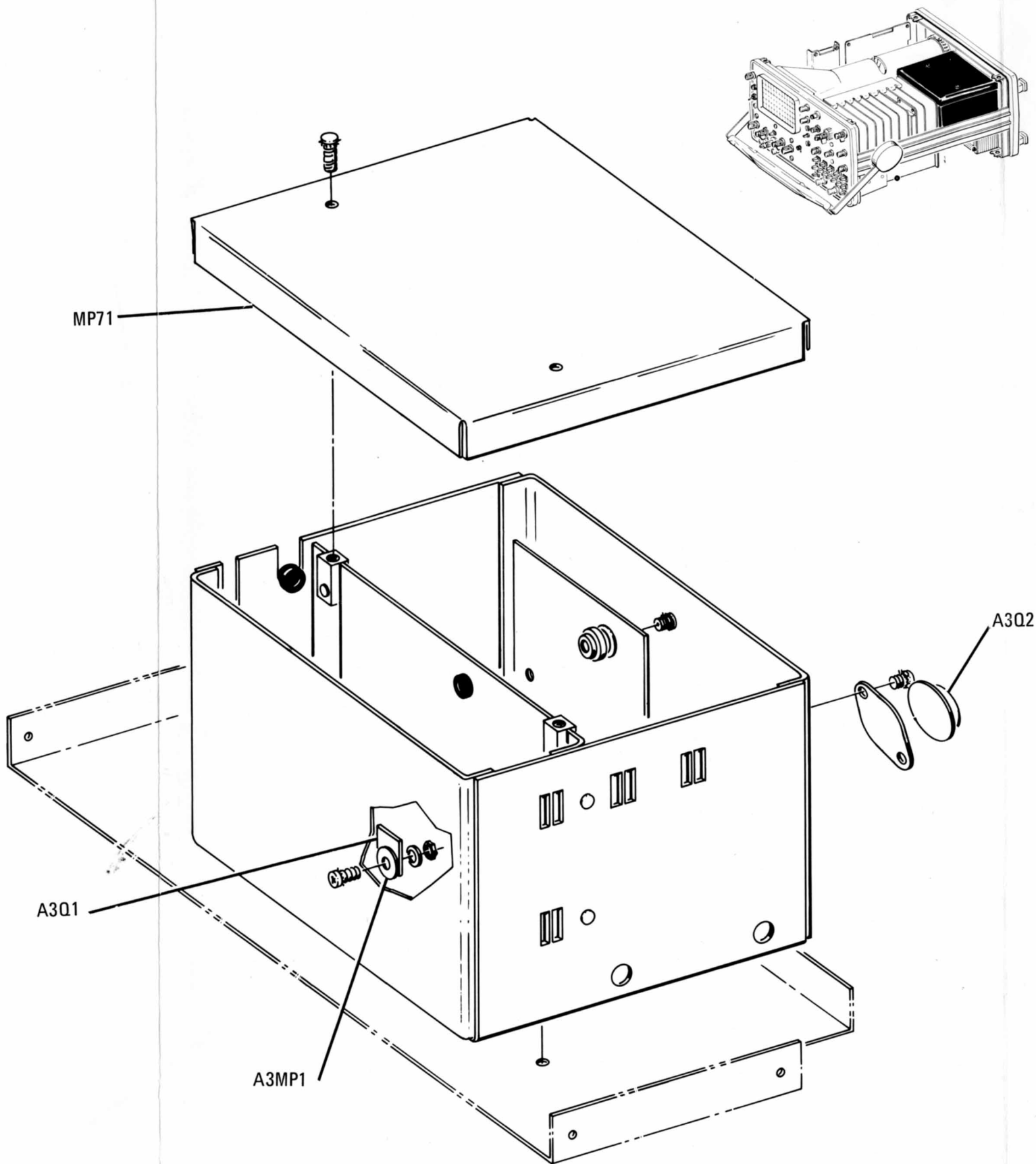
Figure 6-2.
Model 1707B Illustrated Parts Breakdown (Sheet 1 of 2)
6-3

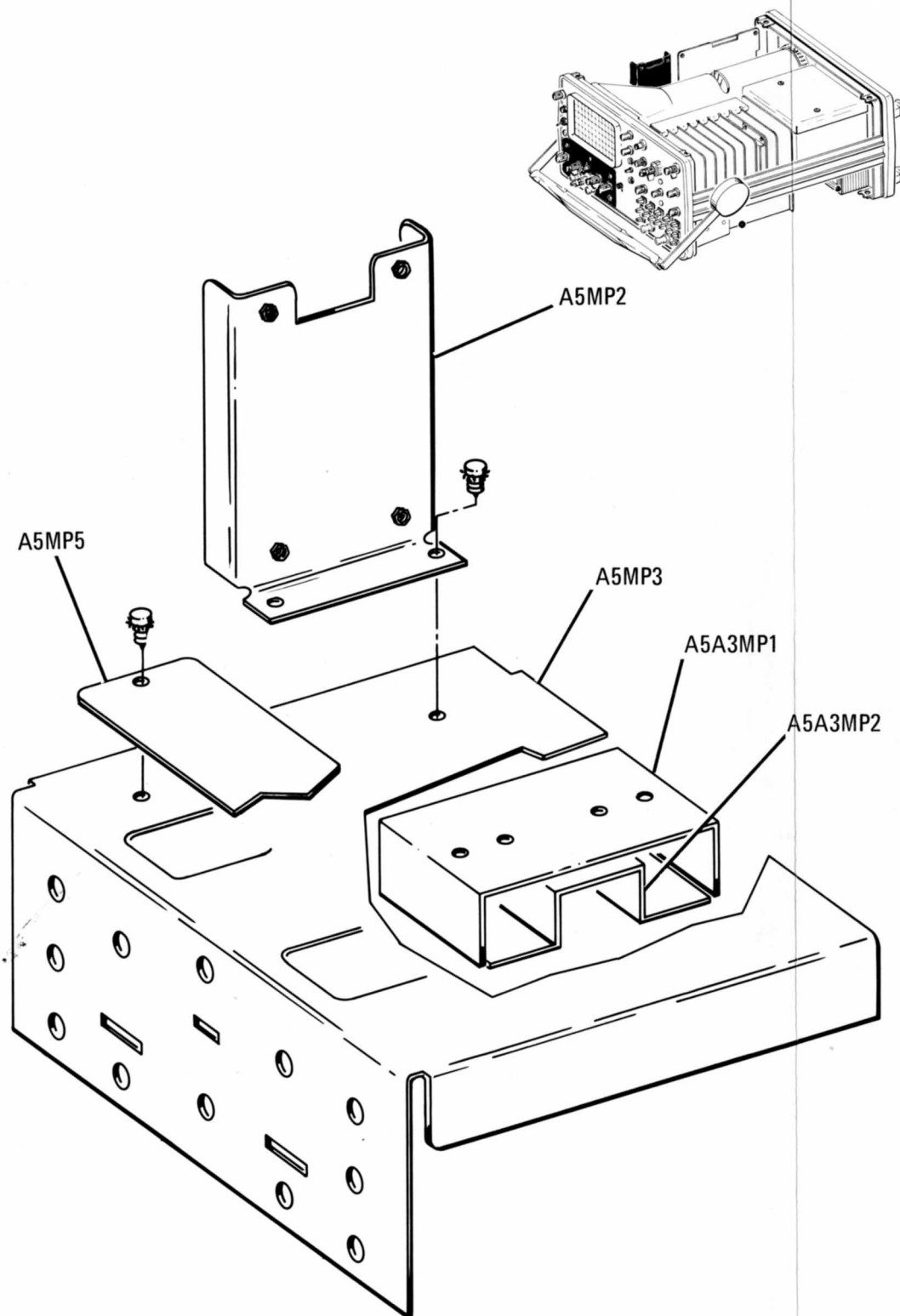


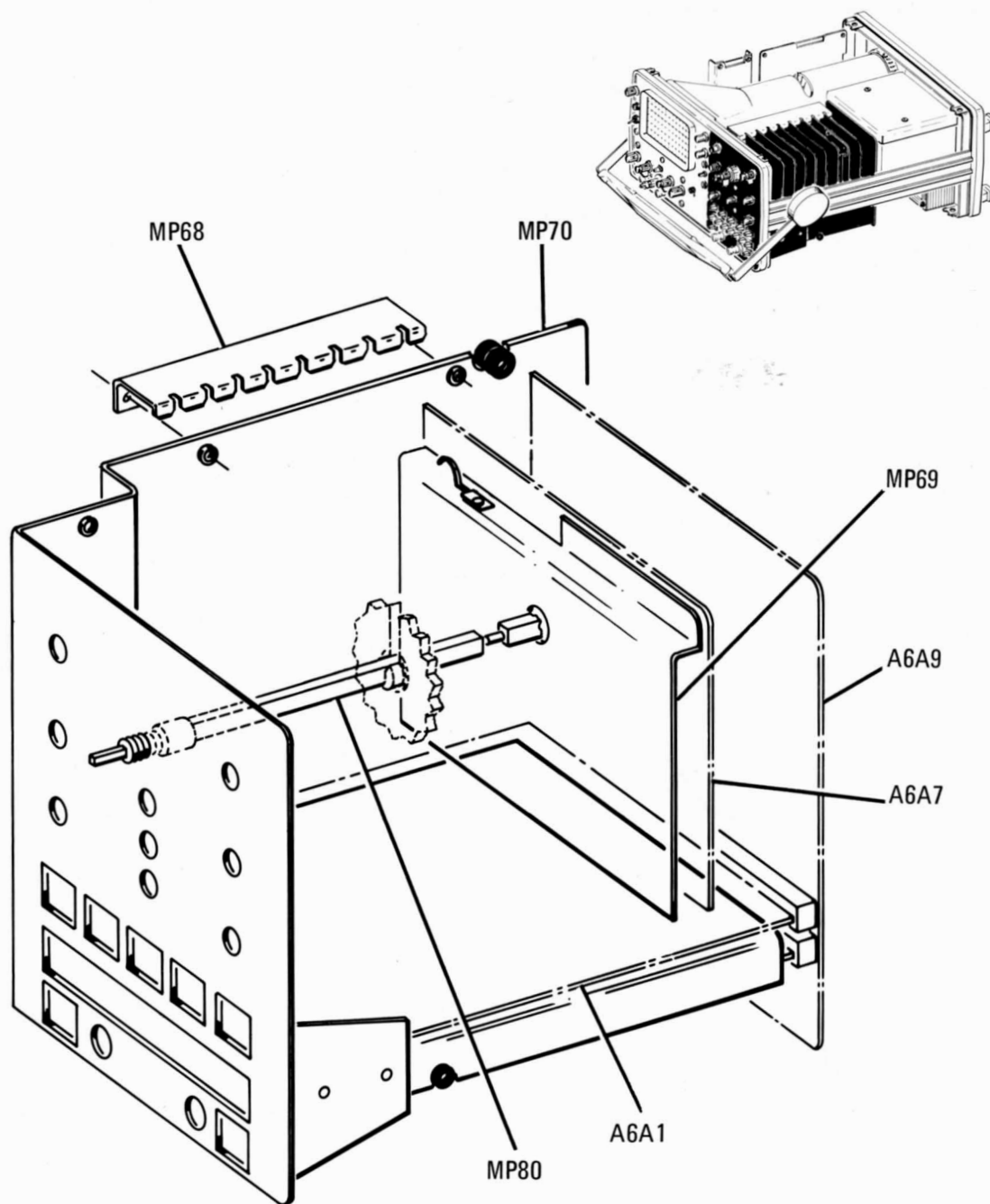


1707B-L-004

Figure 6-2.
Model 1707B Illustrated Parts Breakdown (Sheet 1 of 2)
6-3







1707B-L-005

Figure 6-2. Model 1707B Illustrated Parts Breakdown (Sheet 2 of 2)

Table 6-2. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	5060-1196		POWER LINE INPUT ASSY	28480	5060-1196
A2	01701-66553		BOARD ASSY: LINE RECT	28480	01701-66553
A3	01707-61103		POWER SUPPLY ASSY	28480	01707-61103
A4	01701-66546		BOARD ASSY: GATE	50439	01701-66546
A5	01707-65804		VERTICAL AMPLIFIER MODULE ASSY	28480	01707-65804
A6	01707-65812		HORIZONTAL AMPLIFIER MODULE ASSY	28480	01707-65812
A7	01701-26520		BOARD: SCALE ILLUMINATION	50439	01701-26520
A8	01701-66524		EXTERNAL HORIZONTAL AMPLIFIER BD ASSY	28480	01701-66524
DS1	1450-0710	1	LIGHT, IND, NEON, AMB TP LENS	72765	6140-000-603
DS2	1450-0709		LIGHT, INC, NEON AMP TP LENS, RESET	28480	1450-0709
DS3	1450-0709		LIGHT, IND, NEON AMP TP LENS, VERN UNCAL	28480	1450-0709
F1	2110-0002	1	FUSE, 2A 250V	71400	AGC-2
F2	2110-0003	1	FUSE, 3A 250V	71400	AGC-3
J1	1251-2505	1	CONNECTOR, 2-CONT, FEM, UTILITY	27264	1545-R1
J2	01701-67602	1	CONNECTOR ASSY: DC POWER	28480	01701-67602
J3	1250-0118		CONNECTOR-COAX, BNC, 50 OHM FEMALE (EXT HORIZ TRIG MAIN)	95712	30384-1
J4	1250-0118		CONNECTOR-COAX, BNC, 50 OHM FEMALE (EXT HORIZ TRIG DELAY)	95712	30384-1
J5	1250-0118		CONNECTOR-COAX, BNC, 50 OHM FEMALE	95712	30384-1
J6	1250-0118		CONNECTOR-COAX, BNC, 50 OHM FEMALE (Z-AXIS)	95712	30384-1
L1	01701-66001	2	COIL ASSY: ALIGNMENT	28480	01701-66001
L2	01701-66001		COIL ASSY: ALIGNMENT	28480	01701-66001
MP1	01707-00224	1	PANEL: FRONT	28480	01707-00224
MP2	01701-20504	1	FRAME: FRONT	28480	01701-20504
MP3	01701-24702	1	SUPPORT: CRT-CAMERA	28480	01701-24702
MP4	01701-07101	1	MASK: CRT	28480	01701-07101
MP5	4040-0814	1	BEZEL: OLIVE, BLACK	28480	4040-0814
MP6	01701-09103	1	SPRING: FILTER CONTRAST	28480	01701-09103
MP7	0370-1005	1	KNOB, BASE, PTR, .375 IN, JGK, SGI	28480	0370-1005
MP8	0370-2452	1	KNOB, CONC, BAR AND PTR, .5 IN, JGK	28480	0370-2452
MP9	0370-0962	1	KNOB, CONC, RND, .5 IN, JGK, SGI DECAL	28480	0362-0962
MP10	0370-0966	1	KNOB ASSY	28480	0370-0966
MP11	0370-0929	1	KNOB: LEVER, JADE GREY	28480	0370-0929
MP12	0370-2167	1	KNOB: RND .5"	28480	0370-2167
MP13	0370-1099	1	KNOB, BASE, PTR, .5 IN, JGK, SGI DECAL	28480	0370-1099
MP14	1140-0036	1	COUNTING-DISPLAY, TURNS DIAL 2 SCALES	12697	461
MP15	0370-0959	1	KNOB, BASE, RND, .375 IN, JGK, SGI	28480	0362-0959
MP16	0370-0963	1	KNOB, CONC, RND, .5 IN, JGK, SGI DECAL	28480	0370-0963
MP17	0370-1100	1	KNOB, BASE-CONC PTR, .5 IN, JGK	28480	0370-1100
MP18	0370-0964	1	KNOB, CONC, PTR, .375 IN, JGK, SGI	28480	0370-0964
MP19	0370-2173	1	KNOB, BASE-CONC RND BAR/SKIRT, .5 IN,	28480	0370-2173
MP20	0270-2397	1	KNOB ASSY: DELAYED TIME/DIV	50439	0370-2397
MP21	01701-67404	1	KNOB ASSY	28480	01701-67404
MP22	0370-0958	2	KNOB, BASE, RND, .375 IN, JGK, SGI	28480	0362-0958
MP23	0370-0957	1	KNOB, BASE, RND, SKT, .375 IN, JGK, SGI	28480	0362-0957
MP24	0370-0958	1	KNOB, BASE, RND, .375 IN, JGK, SGI	28480	0362-0958
MP25	0370-0610	10	PUSHBUTTON OLIVE GREEN	28480	0370-0610
MP26	0370-0671	4	PUSHBUTTON LEG BLUE	28480	0370-0671
MP27	0370-0604	1	PUSHBUTTON B POLARITY	28480	0370-0604
MP28	0370-0606	15	BEZEL: PUSHBUTTON, JADE GRAY	28480	0370-0606
MP29	0370-1129	1	KNOB .5 CONC BAR	28480	0370-1129
MP30	1510-0038	1	BINDING-POST, SINGLE, 1/4-32	28480	1510-0038
MP31	0510-0097	1	RETAINER, PUSH ON, .3 DIA, CAD PLT STL	78553	C185-014-24D
MP32	01701-23708	1	RAIL: SIDE	28480	01701-23708
MP33	01701-04105	1	COVER: RAIL, REAR	28480	01701-04105
MP34	01701-64101	1	COVER ASSY: RAIL FRONT	28480	01701-64101
MP35	5020-8734		GEAR: RING HANDLE	28480	5020-8734
MP36	5020-8733		GEAR: HUB HANDLE	28480	5020-8733
MP37	1460-0604		SPRING COMPRESSION	28480	1460-0604
MP38	5040-0511		CAP: TRIM HANDLE	28480	5040-0511
MP39	5040-0515		GRIP HANDLE	28480	5040-0515
MP40					
thru					
MP51			NOT ASSIGNED		
MP52	01707-00219	1	PANEL: REAR (INCL S2)	28480	01707-00219
MP53	01701-20502	1	FRAME: REAR	28480	01701-20502
MP54	5000-5085	1	CLIP: FAN	28480	5000-5085
MP55	5040-5861	4	FOOT: BASE	28480	5040-5861
MP56	01701-04109	1	COVER: TRANSFORMER	28480	01701-04109
MP57	01701-04108	1	COVER: CRT	28480	01701-04108
MP58	01707-00101	1	DECK: BATTERY	28480	01707-00101
MP59	01703-00603	1	SHIELD: GATE	28480	01703-00603
MP60			NOT ASSIGNED		
MP61			NOT ASSIGNED		

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
MP62			NOT ASSIGNED		
MP63			NOT ASSIGNED		
MP64	01701-61201		BRACKET ASSY:SWITCH	28480	01701-61201
MP65	01701-00605		SHIELD:SWITCH OUTER	28480	01701-00605
MP66	01701-00607		SHIELD:SWITCH INNER	28480	01701-00607
MP67	01701-23203	1	COLLAR:ANTI-ROTATION	28480	01701-23203
MP68	01701-02303	1	KEEPER:PC BOARDS	28480	01701-02303
MP69	01701-00609	1	SHIELD:HOLD-OFF	28480	01701-00609
MP70	01701-60602	1	SHIELD ASSY:HORIZONTAL	28480	01701-60602
MP71	01701-04101	1	COVER:POWER BOX	28480	01701-04101
MP72	01707-65501	1	BOX:POWER ASSY	28480	01707-65501
MP73	1400-0798	1	CLAMP:CRT, OLIVE	28480	1400-0798
MP74	0380-0536	2	STANDOFF, ROUND, FEMALE, .438 L	28480	0380-0536
MP75	01701-00601	1	SHIELD:CRT	28480	01701-00601
MP76	01701-04102	1	COVER:TOP	28480	01701-04102
MP77	01701-04103	1	COVER:BOTTOM	28480	01701-04103
MP78	1500-0364	1	DRIVE, CLR .251 ID .5 OD .281 W	00835	7C2-11608MOD
MP79	0510-1036	1	DRIVE, CLR .25 ID .5 OD .25 W	81812	G67-4
MP80	01701-63705	1	SHAFT ASSY:SWEEP TIME	50439	01701-63705
MP81			NOT ASSIGNED		
MP82			NOT ASSIGNED		
MP83	01701-23701	1	SHAFT:POT FXTN	28480	01701-23701
MP84	1200-0037	1	SOCKET, ELEC, TUBE 14-CONT CRT PKG	28480	1200-0037
MP85	1200-0408	1	COVER:CRT SOCKET	28480	1200-0408
MP86	0340-0450	1	INSULATOR, XSTR, X58A, .145 ID, .003	91500	14BSR52600F13
MP87	1390-0088	8	FASTENER, PANEL, QUARTER TURN, RETAINER	28480	1390-0088
MP88	1390-0211	8	FASTENER, PANEL, QUARTER TURN, STUD	28480	1390-0211
MP89	1390-0084	8	FASTENER, PANEL, QUARTER TURN	94227	82-47-101-15
MP90	0510-1142	1	RETAINER, PUSH ON, .875 DIA, CAD PLT	79136	5105-87-ST-CD
MP91	0403-0176	4	FOOT:BUMPER, RUBBER 0.938" DIA	98159	R-19
MP92			NOT ASSIGNED		
MP93	5040-5862	4	FOOT:REAR,CAP	28480	5040-5862
MP94	6960-0068	8	PLUG, HOLE, STANDARD HD, .161 DIA STEEL	57771	D4182
MP95			NOT ASSIGNED		
MP96	01701-67420	1	KNOB:DELAYED TRIGGER LEVEL	28480	01701-67420
MP97	01701-67419	1	KNOB:DELAYED VERNIER	28480	01701-67419
MP98	01700-67407		KNOB ASSY, EXT HORIZ VERNIER	28480	01700-67407
P1	1251-2588	1	CONNECTOR, 12-CONT, MALE, UTILITY	27264	1625-12P-1
P2			NOT ASSIGNED		
R1	2100-3023	1	RESISTOR, VAR, CONT, 10K 20% CC	28480	2100-3023
R2	2100-3017	1	RESISTOR, VAR, CONT, 2.5M 10% C	28480	2100-3017
R3	2100-3022	1	RESISTOR, VAR, CONT, 10K 20% CC	28480	2100-3022
R4	2100-0428	1	RESISTOR, VAR, CONT, 20K 20% CC	28480	2100-0428
R5	2100-3021	1	RESISTOR, VAR, CONT, 100K 20% CC	28480	2100-3021
R6	2100-2588	1	RESISTOR, VAR, 5K 10% MC SPST SW	28480	2100-2588
S1	3101-0940	1	SWITCH, TGL, DPDT 5A/115VAC ON-NONE-ON	09353	7201-WAT
S2	3101-1391	1	SWITCH	28480	3101-1391
S3	3101-0977	1	SWITCH, PB 1-STA STACK DPDT	28480	3101-0977
T1	01701-61105	1	TRANSFORMER ASSY	28480	01701-61105
V1	5083-2752	1	CRT:P31 ALUM. INT. GRATICULE	50439	5083-2752
W1	01701-61610	1	CABLE ASSY:COAX	28480	01701-61610
W2	01703-61604	1	CABLE:COAX PREAMP TO GATE BLUE CAP	50439	01703-61604
W3	01701-61624	1	CABLE:COAX GATE TO CAL OUT YELLOW CAP	50439	01701-61624
W4	01703-61603	1	CABLE:COAX VERT PREAMP TO GATE WHITE CAP	50439	01703-61603
W5	01701-61623	1	CABLE:COAX Z-AXIS INPT YELLOW CAP	50439	01701-61623
W6	01701-61609	2	CABLE:COAX	28480	01701-61609
W7	01701-61613	1	CABLE:SHIELDED	28480	01701-61613
W8	01701-61605	1	CABLE ASSY:TWIN LEAD	28480	01701-61605
W9	8120-1521	1	CABLE, UNSHLD 3-COND 18AWG	70903	KH 7147
W10	01701-61505	1	CABLE ASSY:TWIN LEAD CRT TO HORIZ	50439	01701-61505
W11	01701-61625	1	CABLE:COAX LINE SYNC BLUE CAP	50439	01701-61625
W12	01707-61613	1	CABLE ASSY:SYNC	28480	01707-61613
W13	01701-61609		CABLE:COAX	28480	01701-61609
W14	01701-61626	1	CABLE: MAIN ASSY	28480	01701-61626
XF1	1400-0084	1	FUSEHOLDER, EXTR POST, BAY CAP, 15A	95987	342014
Z1	1901-0526	1	DIODE, MULT, FULL WAVE BRIDGE RECTIFIER	28480	1901-0526

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	5060-1196	1	POWER LINE INPUT ASSY	28480	5060-1196
A1F1	2110-0018	1	FUSE, .25A 125V SLO-BLD (FOR 230V OPERATION)	75915	313.250
A1F1	2110-0008	1	FUSE, .5A 125V SLO-BLD (FOR 115V OPERATION)	75915	313.500
A1J1			N.S.R. PART OF A1.		
A1S1			N.S.R. PART OF A1.		
A2	01701-66553	1	BOARD ASSY: LINE RECT	28480	01701-66553
A2C1	0160-3453	22	CAPACITOR, FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A2C2	0180-2351	1	CAPACITOR, FXD, 2000UF+75-10% 50VDC AL	28480	0180-2351
A2C3	0150-0084	13	CAPACITOR, FXD, .1UF+80-20% 100WVDC	28480	0150-0084
A2CR1	1901-0045	9	DIODE, PWR RECT, SI, 100V MAX VRM 750MA	28480	1901-0045
A2R1	0811-1204	1	RESISTOR, FXD, 200 OHM5% 5W PW TUBULAR	56289	243E2015
A2R2	0687-1031	1	RESISTOR, FXD, 10K10% .5W CC TUBULAR	01121	EB1031
A2R3	0684-1041	16	RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	CB1041
A2R4	0684-1521	2	RESISTOR, FXD, 1.5K10% .25W CC TUBULAR	01121	CB1521
A3	01707-61103	1	POWER SUPPLY ASSY	28480	01707-61103
A3MP1	1200-0077	1	INSULATOR: TRANSISTOR, MICA	16037	#112
A3Q1	5080-9690	1	TRANSISTOR ASSY: SI NPN	28480	5080-9690
A3Q2	1854-0063	1	TRANSISTOR, 2N3055 NPN SI	80131	2N3055
A3W1	01700-61609	1	CABLE: HIGH VOLTAGE	50439	01700-61609
A3A1	01701-66549	1	BOARD ASSY: MOTHER	50439	01701-66549
A3A1C1	0180-1819	1	CAPACITOR, FXD, 100UF+75-10% 50VDC AL	56289	3001076050DH2
A3A1C2	0160-0302		CAPACITOR, FXD, .018UF +-10% 200WVDC	56289	292P18392
A3A1C3	0180-2148	1	CAPACITOR, FXD, .47UF +-20% 50VDC TA	56289	150D474X0050A2
A3A1C4	0150-0084		CAPACITOR, FXD, .1UF+80-20% 100WVDC	28480	0150-0084
A3A1C5	0150-0084		CAPACITOR, FXD, .1UF+80-20% 100WVDC	28480	0150-0084
A3A1C6	0180-0159	4	CAPACITOR, FXD, 220UF+-20% 10VDC TA	56289	1500227X0010S2
A3A1C7	0180-0230	12	CAPACITOR, FXD, .1UF+-20% 50VDC TA-SOLID	56289	1500105X0050A2
A3A1C8	0150-0084		CAPACITOR, FXD, .1UF+80-20% 100WVDC	28480	0150-0084
A3A1C9	0180-0159		CAPACITOR, FXD, 220UF+-20% 10VDC TA	56289	1500227X0010S2
A3A1C10	0160-3451	23	CAPACITOR, FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A3A1CR1	1901-0045		DIODE, PWR RECT, SI, 100V MAX VRM 750MA	28480	1901-0045
A3A1CR2	1901-0045		DIODE, PWR RECT, SI, 100V MAX VRM 750MA	28480	1901-0045
A3A1CR3	1901-0418	1	DIODE, PWR RECT, SI, 400V MAX VRM 1.5A	28480	1901-0418
A3A1CR4	1901-0040	84	DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A3A1CR5	1884-0094	1	THYRISTOR, DIAC	28480	1884-0094
A3A1CR6	1901-0045		DIODE, PWR RECT, 100V MAX VRM 750MA	28480	1901-0045
A3A1J1	01701-67601	1	CONNECTOR ASSY	28480	01701-67601
A3A1L1	9100-3139	11	COIL: 75 OH	28480	9100-3139
A3A1L2	9100-3139		COIL: 75 OH	28480	9100-3139
A3A1L3	9140-0210	3	COIL, FXD, MOLDED RF CHOKE, 100UH 5%	24226	15/103
A3A1L4	9140-0210		COIL, FXD, MOLDED RF CHOKE, 100UH 5%	24226	15/103
A3A1L5	9100-3139		COIL: 75 OH	28480	9100-3139
A3A1L6	9100-3139		COIL: 75 OH	28480	9100-3139
A3A1L7	9140-0210		COIL, FXD, MOLDED RF CHOKE, 100UH 5%	24226	15/103
A3A1L8	9100-3139		COIL: 75 OH	28480	9100-3139
A3A1L9	9100-3139		COIL: 75 OH	28480	9100-3139
A3A1Q1	1854-0090	1	TRANSISTOR, NPN SI	28480	1854-0090
A3A1R1	0761-0015	1	RESISTOR, FXD, 1.5K5% 1W MO TUBULAR	24546	FP32-1-T00-1501-J
A3A1R2	0687-4711	1	RESISTOR, FXD, 470 OHM10% .5W CC	01121	EB4711
A3A1R3	0684-1011	45	RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A3A1R4	0687-2201	1	RESISTOR, FXD, 22 OHM10% .5W CC TUBULAR	01121	EB2201
A3A1R5	0811-1673	1	RESISTOR, FXD, 3.9 OHM5% 2W PW TUBULAR	75042	BWH2-3R9-J
A3A1R6	0812-0086	1	RESISTOR, FXD, 5 OHM5% 3W PW TUBULAR	91637	CW2B1-3W-T2-5R0-J
A3A1R7	0684-4701	2	RESISTOR, FXD, 47 OHM10% .25W CC	01121	CB4701
A3A1R8	0684-4711	3	RESISTOR, FXD, 470 OHM10% .25W CC	01121	CB4711
A3A1R9	0684-4711		RESISTOR, FXD, 470 OHM10% .25W CC	01121	CB4711
A3A1R10	0684-1041		RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	CB1041
A3A1R11	0684-1041		RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	CB1041
A3A1R12	0684-2731	4	RESISTOR, FXD, 27K10% .25W CC TUBULAR	01121	CB2731
A3A1R13	0684-2731		RESISTOR, FXD, 27K10% .25W CC TUBULAR	01121	CB2731
A3A1R14	0684-1031	18	RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A3A1R15	0684-2731		RESISTOR, FXD, 27K10% .25W CC TUBULAR	01121	CB2731
A3A1R16	0684-2731		RESISTOR, FXD, 27K10% .25W CC TUBULAR	01121	CB2731
A3A1R17	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A3A1R18	0684-1041		RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	CB1041
A3A1R19	0698-4306		RESISTOR, FXD, 150K 5% .125W F TUBULAR	16299	C4-1/8-T0-1503-J
A3A1R20	0687-1011		RESISTOR, FXD, 100 OHM 10% .5W CC TUBULAR	01121	EB 1011
A3A1SCR1	1884-0082	1	THYRISTOR, SCR, JEDEC 2N4441	04713	2N4441
A3A1T1	01701-61104	1	TOROID: FERRITE	28480	01701-61104
A3A1VR1	1902-3302	1	DIODE, VREG, 34.8V VZ, .4W MAX	28480	1902-3302
A3A1VR2	1902-3059	2	DIODE, VREG, 3.83V VZ, .4W MAX	28480	1902-3059
A3A1VR3	1902-3315	1	DIODE, VREG, 39.2V VZ, .4W MAX	28480	1902-3315
A3A1VR4	1902-3002	1	DIODE, VREG, 2.37V VZ, .4W MAX	28480	1902-3002
A3A1XA1			NOT ASSIGNED		
A3A1XA2	1251-1968	2	CONNECTOR, PC EDGE, 10-CONT, DIP SOLDER	26742	91-6910-1700-00
A3A1XA3	1251-1968		CONNECTOR, PC EDGE, 13-CONT, DIP SOLDER	26742	91-6910-1700-00
A3A2	01701-66554	1	BOARD ASSY: LOW VOLTAGE CONVERTER	50439	01701-66554

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A2C1	0150-0084	10	CAPACITOR-FXD, .1UF+80-20% 100WVDC	28480	0150-0084
A3A2C2	0150-0084		CAPACITOR-FXD, .1UF+80-20% 100WVDC	28480	0150-0084
A3A2C3	0180-0098		CAPACITOR-FXD, 100UF+-20% 20VDC TA	56289	1500107X0020S2
A3A2C4	0180-1802		CAPACITOR-FXD, 150UF+75-10% 40VDC AL	56289	39D157G040EJ4
A3A2C5	0180-0098		CAPACITOR-FXD, 100UF+-20% 20VDC TA	56289	1500107X0020S2
A3A2C6	0180-1780	1	CAPACITOR-FXD, 500UF+75-10% 10VDC AL	56289	39D507G010EJ4
A3A2C7	0160-0168	4	CAPACITOR-FXD, .1UF+-10% 200WVDC	56289	292P10492
A3A2C8	0160-0380	1	CAPACITOR-FXD, .22UF+-10% 200WVDC	28480	0160-0380
A3A2C9	0150-0084		CAPACITOR-FXD, .1UF+80-20% 100WVDC	28480	0150-0084
A3A2C10	0160-3451		CAPACITOR-FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A3A2C11	0150-0084	3	CAPACITOR-FXD, .1UF+80-20% 100WVDC	28480	0150-0084
A3A2C12	0160-2141		CAPACITOR-FXD, 680PF+-20% 1000WVDC	28480	0160-2141
A3A2C13	0160-0168		CAPACITOR-FXD, .1UF+-10% 200WVDC	56289	292P10492
A3A2C14	0160-0168		CAPACITOR-FXD, .1UF+-10% 200WVDC	56289	292P10492
A3A2CR1	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A3A2CR2	1901-0040	4	DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A3A2CR3	1901-0049		DIODE, PWR RECT, SI, 50V MAX VRM 750MA	28480	1901-0049
A3A2CR4	1901-0049		DIODE, PWR RECT, SI, 50V MAX VRM 750MA	28480	1901-0049
A3A2CR5	1901-0045		DIODE, PWR RECT, SI, 100V MAX VRM 750MA	28480	1901-0045
A3A2L1	9140-0128	1	COIL, FXD, MOLDED RF CHOKER, 22MH 5%	99800	BP-964
A3A201	1855-0010	1	TRANSISTOR, UNIJUNCTION, P ON N 2N2646	03508	2N2646
A3A202	1854-0476	1	TRANSISTOR, 2N3879 NPN SI	02735	2N3879
A3A203	1854-0039	1	TRANSISTOR, 2N3053 NPN SI	04713	2N3053
A3A204	1853-0027	1	TRANSISTOR, PNP SI	28480	1853-0027
A3A2R1	0684-1221	10	RESISTOR, FXD, 1.2K10% .25W CC TUBULAR	01121	CR1221
A3A2R2	0684-2721	2	RESISTOR, FXD, 2.7K10% .25W CC TUBULAR	01121	CB2721
A3A2R3	2100-1760	2	RESISTOR, VAR, TRMR, 5KOHM 5% WW	28480	2100-1760
A3A2R4	0757-0199	1	RESISTOR, FXD, 21.5K1% .125W F TUBULAR	24546	C4-1/8-T0-2152-F
A3A2R5	0757-0442	8	RESISTOR, FXD, 10K1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A3A2R6	0684-4721	9	RESISTOR, FXD, 4.7K10% .25W CC TUBULAR	01121	CB4721
A3A2R7	0684-1011	2	RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A3A2R8	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A3A2R9	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A3A2R10	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A3A2R11	0698-3159		RESISTOR, FXD, 26.1K1% .125W F TUBULAR	16299	C4-1/8-T0-2612-F
A3A2R12	0757-0401	14	RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A3A2R13	0684-1521		RESISTOR, FXD, 1.5K10% .25W CC TUBULAR	01121	CB1521
A3A2R14	0684-1041		RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	CB1041
A3A2R15	0684-2211		RESISTOR, FXD, 220 OHM10% .25W CC	01121	CB2211
A3A2R16	0813-0050		RESISTOR, FXD, 100 OHM5% 3W PW TUBULAR	91637	CW281-3W-T2-101-J
A3A2T1	9100-3152	1	TRANSFORMER	28480	9100-3152
A3A2U1	1820-0058	1	INTEGRATED CIRCUIT, LIN, OP AMPL.	07263	U58770939X
A3A2VR1	1902-0033	2	DIODE, VREG, 6.2V VZ, .25W MAX	03877	1N823
A3A2VR2	1902-3256	1	DIODE, VREG, 23.7V VZ, .4W MAX	28480	1902-3256
A3A2VR3	1902-0197	1	DIODE, VREG, 82.5V VZ, 1W MAX	28480	1902-0197
A3A3	01701-66537	1	BOARD ASSY:RECTIFIER FILTER	50439	01701-66537
A3A3C1	0180-0091	2	CAPACITOR-FXD, 10UF+50-10% 100VDC AL	56289	30D106F100DC2
A3A3C2	0180-2344	4	CAPACITOR-FXD, 150UF+75-10% 75VDC AL	56289	39D157G075FJ4
A3A3C3	0180-0098		CAPACITOR-FXD, 100UF+-20% 20VDC TA	56289	1500107X0020S2
A3A3C4	0180-0098		CAPACITOR-FXD, 100UF+-20% 20VDC TA	56289	1500107X0020S2
A3A3C5	0180-0098		CAPACITOR-FXD, 100UF+-20% 20VDC TA	56289	1500107X0020S2
A3A3C6	0180-0159		CAPACITOR-FXD, 220UF+-20% 10VDC TA	56289	150D227X0010S2
A3A3C7	0180-2344	1	CAPACITOR-FXD, 150UF+75-10% 75VDC AL	56289	39D157G075FJ4
A3A3C8	0180-0098		CAPACITOR-FXD, 100UF+-20% 20VDC TA	56289	1500107X0020S2
A3A3C9	0180-0098		CAPACITOR-FXD, 100UF+-20% 20VDC TA	56289	1500107X0020S2
A3A3C10	0180-0098		CAPACITOR-FXD, 100UF+-20% 20VDC TA	56289	1500107X0020S2
A3A3CR1	1901-0646	8	DIODE, PWR RECT, SI, 200V MAX VRM 1A	28480	1901-0646
A3A3CR2	1901-0646		DIODE, PWR RECT, SI, 200V MAX VRM 1A	28480	1901-0646
A3A3CR3	1901-0646		DIODE, PWR RECT, SI, 200V MAX VRM 1A	28480	1901-0646
A3A3CR4	1901-0646		DIODE, PWR RECT, SI, 200V MAX VRM 1A	28480	1901-0646
A3A3CR5	1901-0646		DIODE, PWR RECT, SI, 200V MAX VRM 1A	28480	1901-0646
A3A3CR6	1901-0646	1	DIODE, PWR RECT, SI, 200V MAX VRM 1A	28480	1901-0646
A3A3CR7	1901-0646		DIODE, PWR RECT, SI, 200V MAX VRM 1A	28480	1901-0646
A3A3CR8	1901-0646		DIODE, PWR RECT, SI, 200V MAX VRM 1A	28480	1901-0646
A3A3L1	9100-3139		COIL:75 UH	28480	9100-3139
A3A3L2	9100-3139		COIL:75 UH	28480	9100-3139
A3A3MP1	0403-0175	1	BUMPER:RUBBER 0.750" DIA	77969	6657
A3A3MP2	1400-0475	1	CLAMP, SNAP-IN, .438 DIA .5 L VINYL	24618	721-0004
A3A3T1	9100-3235	1	TRANSFORMER:TOROID 8 SEC.	28480	9100-3235
A3A4	01701-66556	1	BOARD ASSY:HIGH VOLTAGE OSCILLATOR	50439	01701-66556
A3A4A1	01701-61107	1	HIGH VOLTAGE TRANSFORMER ASSY	50439	01701-61107
A3A4C1	0160-0168		CAPACITOR-FXD, .1UF+-10% 200WVDC	56289	292P10492

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A4C2	0160-2403	1	CAPACITOR,FXD, .0015UF+-20% 5000WVDC	28480	0160-2403
A3A4C3	0160-3453		CAPACITOR,FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A3A4C4	0180-0291	3	CAPACITOR-FXD, 1UF+-10% 35VDC TA-SOLID	56289	1500105X9035A2
A3A4C5	0180-1746	6	CAPACITOR-FXD, 15UF+-10% 20VDC TA-SOLID	56289	1500156X9020B2
A3A4C6	0170-0040	1	CAPACITOR,FXD, .047UF+-10% 200WVDC	56289	292P47392
A3A4C7	0160-3453		CAPACITOR,FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A3A4C8	0160-3800	5	CAPACITOR,FXD, .005UF+-20% 3000WVDC	28480	0160-3800
A3A4C9	0160-3801	6	CAPACITOR,FXD, .005UF+-20% 3000WVDC	28480	0160-3801
A3A4C10			NOT ASSIGNED		
A3A4C11	0160-3800		CAPACITOR,FXD, .005UF+-20% 3000WVDC	28480	0160-3800
A3A4C12			NOT ASSIGNED		
A3A4C13	0160-3801		CAPACITOR,FXD, .005UF+-20% 3000WVDC	28480	0160-3801
A3A4C14	0160-3801		CAPACITOR,FXD, .005UF+-20% 3000WVDC	28480	0160-3801
A3A4C15	0160-3801		CAPACITOR,FXD, .005UF+-20% 3000WVDC	28480	0160-3801
A3A4C16	0160-3800		CAPACITOR,FXD, .005UF+-20% 3000WVDC	28480	0160-3800
A3A4C17	0160-3800		CAPACITOR,FXD, .005UF+-20% 3000WVDC	28480	0160-3800
A3A4C18	0160-3801		CAPACITOR,FXD, .005UF+-20% 3000WVDC	28480	0160-3801
A3A4C19	0160-3801		CAPACITOR,FXD, .005UF+-20% 3000WVDC	28480	0160-3801
A3A4C20			NOT ASSIGNED		
A3A4C21	0160-3800		CAPACITOR,FXD, .005UF+-20% 3000WVDC	28480	0160-3800
A3A4C22	0180-1746		CAPACITOR-FXD, 15UF+-10% 20VDC TA-SOLID	56289	1500156X9020B2
A3A4CR1	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A3A4CR2	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A3A4CR3	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A3A4CR4	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A3A4CR5	1901-0049		DIODE, PWR RECT, SI, 50V MAX VRM 750MA	28480	1901-0049
A3A4CR6	1901-0049		DIODE, PWR RECT, SI, 50V MAX VRM 750MA	28480	1901-0049
A3A4CR7	1901-1022	2	DIODE, HI VOLT RECT, SI, 5KV MAX VRM	28480	1901-1022
A3A4CR8	1901-1022		DIODE, HI VOLT RECT, SI, 5KV MAX VRM	28480	1901-1022
A3A4CR9	1901-0033	1	DIODE, GEN PRP, SI, 180V MAX VRM 200MA	28480	1901-0033
A3A4DS1	2140-0018	2	LAMP, GLOW, BULB T-2, 58V	08806	A9A (NE-2E1)
A3A4DS2	2140-0018		LAMP, GLOW, BULB T-2, 58V	08806	A9A (NE-2E1)
A3A4F1	2110-0033	1	FUSE, .75A 250V	75915	312.750
A3A4L1	9100-2268	1	COIL, FXD, MOLDED RF CHOKE, 22UH 10%	24226	10/222
A3A4MP1	5040-0402	1	MOUNT:TRANSFORMER	28480	5040-0402
A3A4MP2	5040-0430	1	MOUNT:TRANSFORMER	28480	5040-0430
A3A4MP3	2200-0125	1	SCREW,MACHINE, 4-40 UNC-2A 1.5 IN PAN	77250	
A3A4MP4	2110-0769	14	CLIP:FUSE 0.250" DIA	91506	6008-32CN
A3A4MP5	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A3A4MP6			NOT ASSIGNED		
A3A4MP7	2200-0111	1	SCREW,MACHINE, 4-40 UNC-2A .5 IN PAN	77250	
A3A4Q1	1854-0023	1	TRANSISTOR,NPN SI (SELECTED 2N2484)	28480	1854-0023
A3A4Q2	1854-0215	24	TRANSISTOR, NPN SI	04713	SPS 3611
A3A4Q3	1853-0036	22	TRANSISTOR, PNP SI	28480	1853-0036
A3A4R1	2100-2514	1	RESISTOR, VAR, TRMR, 20KOHM 10% C	19701	ET50X203
A3A4R2	0757-0464	1	RESISTOR, FXD, 90.9K1% .125W F TUBULAR	24546	C4-1/8-T0-9092-F
A3A4R3	0698-7807	1	RESISTOR, FXD, 8.5M.1% .2W MF TUBULAR	03888	PME80-2-T0-8504-F
A3A4R4	0698-5922	2	RESISTOR, FXD, 1.8M1% .5W MF TUBULAR	30983	MF7C1/2-T0-1804-F
A3A4R5	0698-5922		RESISTOR, FXD, 1.8M1% .5W MF TUBULAR	30983	MF7C1/2-T0-1804-F
A3A4R6	0684-1021	15	RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	CB1021
A3A4R7	0684-4721		RESISTOR, FXD, 4.7K10% .25W CC TUBULAR	01121	CB4721
A3A4R8	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A3A4R9	0684-4731	2	RESISTOR, FXD, 47K10% .25W CC TUBULAR	01121	CB4731
A3A4R10	0684-1021		RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	CB1021
A3A4R11	0684-1021		RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	CB1021
A3A4R12	0687-5611	1	RESISTOR, FXD, 560 OHM10% .5W CC	01121	FB5611
A3A4R13	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A3A4R14	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A3A4R15	2100-2692	1	RESISTOR, VAR, TRMR, 1MOHM 20% C	19701	ET50X105
A3A4R16	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A3A4R17	0836-0003	1	RESISTOR, FXD, 29M10% 1W CF TUBULAR	77764	BBFW-1-2905-K
A3A4R18	0684-1051	2	RESISTOR, FXD, 1M10% .25W CC TUBULAR	01121	CB1051
A3A4R19	0684-1531	3	RESISTOR, FXD, 15K10% .25W CC TUBULAR	01121	CB1531
A3A4R20	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A3A4R21	0684-4711		RESISTOR, FXD, 470 OHM10% .25W CC	01121	CB4711
A3A4R22	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A4	01701-66546	1	BOARD ASSY:GATE	50439	01701-66546
A4C1	0180-0104	1	CAPACITOR-FXD, 200UF+75-10% 16VDC AL	56289	30D207G0160F2
A4C2	0160-2432	2	CAPACITOR,FXD, .1UF+-5% 100WVDC	84411	863T10451W2
A4C3	0160-3453		CAPACITOR,FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A4C4	0160-3453		CAPACITOR,FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A4C5	0150-0084		CAPACITOR,FXD, .1UF+80-20% 100WVDC	28480	0150-0084
A4C6	0160-3452	3	CAPACITOR,FXD, .02UF+-20% 100WVDC	28480	0160-3452
A4C7	0121-0168	1	CAPACITOR, VAR, TRMR, PSTN, .2/1.5PF	28480	0121-0168

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4C8	0160-3452		CAPACITOR,FXD, .02UF+-20% 100WVDC	28480	0160-3452
A4C9	0150-0084		CAPACITOR,FXD, .1UF+80-20% 100WVDC	28480	0150-0084
A4C10	0150-0084		CAPACITOR,FXD, .1UF+80-20% 100WVDC	28480	0150-0084
A4C11	0150-0084		CAPACITOR,FXD, .1UF+80-20% 100WVDC	28480	0150-0084
A4C12	0180-0091		CAPACITOR-FXD, 10UF+50-10% 100VDC AL	56289	300106F100DC2
A4C13	0180-2344		CAPACITOR-FXD, 150UF+75-10% 75VDC AL	56289	390157G075FJ4
A4C14	0180-0098		CAPACITOR-FXD, 100UF+-20% 20VDC TA	56289	1500107X0020S2
A4C15	0180-0098		CAPACITOR-FXD, 100UF+-20% 20VDC TA	56289	1500107X0020S2
A4C16	0180-2344		CAPACITOR-FXD, 150UF+75-10% 75VDC AL	56289	390157G075FJ4
A4C17	0180-0159		CAPACITOR-FXD, 220UF+-20% 10VDC TA	56289	1500227X0010S2
A4CR1	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A4CR2	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A4CR3	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A4CR4	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A4CR5	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A4CR6	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A4CR7	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A4CR8	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A4CR9	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A4CR10	1901-0045		DIODE, PWR RECT, SI, 100V MAX VRM 750MA	28480	1901-0045
A4CR11	1901-0045		DIODE, PWR RECT, SI, 100V MAX VRM 750MA	28480	1901-0045
A4CR12	1901-0045		DIODE, PWR RECT, SI, 100V MAX VRM 750MA	28480	1901-0045
A4CR13	1901-0045		DIODE, PWR RECT, SI, 100V MAX VRM 750MA	28480	1901-0045
A4CR14	1901-0045		DIODE, PWR RECT, SI, 100V MAX VRM 750MA	28480	1901-0045
A4F1	2110-0004	3	FUSE, .25A 250V	71400	AGC-1/4
A4F2	2110-0004		FUSE, .25A 250V	71400	AGC-1/4
A4F3	2110-0012	3	FUSE, .5A 250V	71400	AGC 1/2
A4F4	2110-0012		FUSE, .5A 250V	71400	AGC 1/2
A4F5	2110-0004		FUSE, .25A 250V	71400	AGC-1/4
A4F6	2110-0012		FUSE, .5A 250V	71400	AGC 1/2
A4L1	9100-3139		COIL:75 UH	28480	9100-3139
A4L2	9100-3139		COIL:75 UH	28480	9100-3139
A4L3	9100-3139		COIL:75 UH	28480	9100-3139
A4MP1	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP2	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP3	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP4	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP5	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP6	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP7	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP8	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP9	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP10	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP11	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP12	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A4MP13	1200-0195	1	SOCKET, ELEC, IC 8-CONT DIP SLD R TERM	91506	8058-1G45
A4MP14	1205-0073	1	HEAT-DISSIPATOR, SGL, TO-5 PKG	28480	1205-0073
A4MP15	1400-0175	1			
A4Q1	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A4Q2	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A4Q3	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A4Q4	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A4Q5	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A4Q6	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A4Q7	1853-0232	1	TRANSISTOR, PNP SI	28480	1853-0232
A4Q8	1854-0419	1	TRANSISTOR, NPN SI	28480	1854-0419
A4Q9	1853-0080	1	TRANSISTOR, PNP SI	28480	1853-0080
A4Q10	1854-0072	1	TRANSISTOR, 2N3054 NPN SI	02735	2N3054
A4R1	0684-2221	10	RESISTOR, FXD, 2.2K10% .25W CC TUBULAR	01121	C82221
A4R2	0684-1021		RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	C81021
A4R3	0757-0435	2	RESISTOR, FXD, 3.92K1% .125W F TUBULAR	24546	C4-1/8-T0-3921-F
A4R4	0684-2721		RESISTOR, FXD, 2.7K10% .25W CC TUBULAR	01121	C82721
A4R5	0757-0453	1	RESISTOR, FXD, 30.1K1% .125W F TUBULAR	24546	C4-1/8-T0-3012-F
A4R6	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	C81011
A4R7	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	C81011
A4R8	0757-0442		RESISTOR, FXD, 10K1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A4R9	0698-3154	1	RESISTOR, FXD, 4.22K1% .125W F TUBULAR	16299	C4-1/8-T0-4221-F
A4R10	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	C81011
A4R11	0684-4721		RESISTOR, FXD, 4.7K10% .25W CC TUBULAR	01121	C84721
A4R12	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	C81011
A4R13	0757-0438	10	RESISTOR, FXD, 5.11K1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A4R14	0757-0454	1	RESISTOR, FXD, 33.2K1% .125W F TUBULAR	24546	C4-1/8-T0-3322-F
A4R15	0684-4721		RESISTOR, FXD, 4.7K10% .25W CC TUBULAR	01121	C84721
A4R16	0684-6811	1	RESISTOR, FXD, 680 OHM10% .25W CC	01121	C86811
A4R17	0757-0457	1	RESISTOR, FXD, 47.5K1% .125W F TUBULAR	24546	C4-1/8-T0-4752-F

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R18	0757-0449	3	RESISTOR, FXD, 20K1% .125W F TUBULAR	24546	C4-1/8-T0-2002-F
A4R19	0757-0273	12	RESISTOR, FXD, 3.01K1% .125W F TUBULAR	24546	C4-1/8-T0-3011-F
A4R20	0757-0421	5	RESISTOR, FXD, 825 OHM1% .125W F	24546	C4-1/8-T0-825R-F
A4R21	0757-0416	5	RESISTOR, FXD, 511 OHM1% .125W F	24546	C4-1/8-T0-511R-F
A4R22	0757-0407	3	RESISTOR, FXD, 200 OHM1% .125W F	24546	C4-1/8-T0-201-F
A4R23	0684-4701		RESISTOR, FXD, 47 OHM10% .25W CC	01121	CB4701
A4R24	0684-1051		RESISTOR, FXD, 1M10% .25W CC TUBULAR	01121	CB1051
A4R25	0684-5631	3	RESISTOR, FXD, 56K10% .25W CC TUBULAR	01121	CB5631
A4R26	0684-1001	10	RESISTOR, FXD, 10 OHM10% .25W CC	01121	CB1001
A4R27	0757-0440	9	RESISTOR, FXD, 7.5K1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A4R28	0684-2221		RESISTOR, FXD, 2.2K10% .25W CC TUBULAR	01121	CB2221
A4R29	2100-1788	1	RESISTOR, VAR, TRMR, 500 OHM 10% C	28480	2100-1788
A4R30	0757-0760	1	RESISTOR, FXD, 20K1% .25W F TUBULAR	24546	C5-1/4-T0-2002-F
A4R31	0684-1021		RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	CB1021
A4R32	0684-4721		RESISTOR, FXD, 4.7K10% .25W CC TUBULAR	01121	CB4721
A4R33	0684-1001		RESISTOR, FXD, 10 OHM10% .25W CC	01121	CB1001
A4R34			NOT ASSIGNED		
A4R35	2100-2030	1	RESISTOR, VAR, TRMR, 20KOHM 10% C	28480	2100-2030
A4VR1	1902-0033		DIODE, VREG, 6.2V VZ, .25W MAX	03877	1N823
A4VR2	1902-0052	1	DIODE, VREG, 6.81V VZ, .4W MAX	28480	1902-0052
A4VR3	1902-0244	1	DIODE, VREG, 30.1V VZ, 1W MAX	28480	1902-0244
A5	01707-65804	1	VERTICAL AMPLIFIER MODULE ASSY	28480	01707-65804
A5C1	0160-2913	2	CAPACITOR,FXD, .01UF+85-20% 500WVDC	28480	0160-2913
A5C2	0160-2913		CAPACITOR,FXD, .01UF+85-20% 500WVDC	28480	0160-2913
A5C3	0160-2257	7	CAPACITOR,FXD, 10PF+-5% 500WVDC	28480	0160-2257
A5C4	0160-2261	3	CAPACITOR,FXD, 15PF+-5% 500WVDC	28480	0160-2261
A5DS1	1450-0709	1	LIGHT, IND, NEON, WHT TP LENS	72765	6140-000-603
A5J1	1250-0118	6	CONNECTOR-COAX, BNC, 50 OHM FEMALE	95712	30384-1
A5J2	1250-0118		CONNECTOR-COAX, BNC, 50 OHM FEMALE	95712	30384-1
A5MP1	1490-0841	1	DRIVE, SFT CPLR .127 ID .281 OD .375 L	28480	1490-0841
A5MP2	01701-00603	2	SHIELD:VERTICAL OUTPUT	28480	01701-00603
A5MP3	01701-00608	2	SHIELD:VERTICAL MODULE	28480	01701-00608
A5MP4	01701-01213	1	BRACKET:DISPLAY SWITCH	28480	01701-01213
A5MP5	01701-04107	2	PLATE:ATTENUATOR COVER	28480	01701-04107
A5MP6	01701-21701	1	BUSHING:POT	28480	01701-21701
A5MP7	01701-24701	3	SPACER:BNC	28480	01701-24701
A5MP8	01707-01201	1	BRACKET:POT	28480	01707-01201
A5MP9	01707-09102	1	SPRING:SHAFT GROUND	28480	01707-09102
A5MP1C	01707-23701	1	SHAFT:POT EXTENDER	28480	01707-23701
A5R1	0757-0476	2	RESISTOR, FXD, 301K1% .125W F TUBULAR	24546	C4-1/8-T0-3013-F
A5R2	0757-0476		RESISTOR, FXD, 301K1% .125W F TUBULAR	24546	C4-1/8-T0-3013-F
A5R3	2100-3007	2	RESISTOR, VAR, CONT, 50K 20% CC	28480	2100-3007
A5R4	2100-3007		RESISTOR, VAR, CONT, 50K 20% CC	28480	2100-3007
A5R5	2100-2492	2	RESISTOR, VAR, CONT, 5K 20% CC	28480	2100-2492
A5R6	0757-0397	2	RESISTOR, FXD, 68.1 OHM1% .125W F	24546	C4-1/8-T0-68R1-F
A5R7	0698-3432	3	RESISTOR, FXD, 26.1 OHM1% .125W F	03888	PME55-1/8-T0-26R1-F
A5R8	2100-2492		RESISTOR, VAR, CONT, 5K 20% CC	28480	2100-2492
A5R9	0757-0397		RESISTOR, FXD, 68.1 OHM1% .125W F	24546	C4-1/8-T0-68R1-F
A5R10	0698-3432		RESISTOR, FXD, 26.1 OHM1% .125W F	03888	PME55-1/8-T0-26R1-F
A5R11	2100-3099	2	RESISTOR, VAR, CONT, 5K 10% C	28480	2100-3099
A5R12	2100-3099		RESISTOR, VAR, CONT, 5K 10% C	28480	2100-3099
A5R13			NOT ASSIGNED		
A5R14			NOT ASSIGNED		
A5S1	3101-1396	1	SWITCH:PUSHBUTTON 2 POLE 1 STATION	28480	3101-1396
A5S2	3100-2557	1	SWITCH:ROTARY 2 POLE 1 STATION	28480	3100-2557
A5W1	01707-61604	1	CABLE ASSY:VERTICAL	28480	01707-61604
A5W2	01707-61605	1	CABLE ASSY:VERTICAL SUB	28480	01707-61605
A5A1	01707-63401	2	ATTENUATOR ASSY	28480	01707-63401
A5A1C1	0150-0115	1	CAPACITOR,FXD, 27PF+-10% 500WVDC	28480	0150-0115
A5A1C2	0170-0043	1	CAPACITOR,FXD, .022UF+-10% 600WVDC	28480	0170-0043
A5A1C3	0160-2204	4	CAPACITOR,FXD, 100PF+-5% 300WVDC	28480	0160-2204
A5A1C4	0121-0483	8	CAPACITOR, VAR, TRMR, PSTN, .5-3PF;	72982	536-016
A5A1C5	0121-0483		CAPACITOR, VAR, TRMR, PSTN, .5-3PF;	72982	536-016
A5A1C6	0160-2257		CAPACITOR,FXD, 10PF+-5% 500WVDC	28480	0160-2257
A5A1C7	0160-2257		CAPACITOR,FXD, 10PF+-5% 500WVDC	28480	0160-2257
A5A1C8	0121-0483		CAPACITOR, VAR, TRMR, PSTN, .5-3PF;	72982	536-016
A5A1C9	0121-0483		CAPACITOR, VAR, TRMR, PSTN, .5-3PF;	72982	536-016
A5A1C10	0150-0074	1	CAPACITOR,FXD, 7PF+-15PF % 500WVDC	28480	0150-0074
A5A1C11	0160-2262	2	CAPACITOR,FXD, 16PF+-5% 500WVDC	28480	0160-2262
A5A1C12	0140-0130	1	CAPACITOR,FXD, 220PF+-5% 500WVDC	72982	TYPE 654-014 (CB11RD
A5A1C13	0121-0483		CAPACITOR, VAR, TRMR, PSTN, .5-3PF;	72982	536-016
A5A1C14	0121-0483		CAPACITOR, VAR, TRMR, PSTN, .5-3PF;	72982	536-016
A5A1C15	0160-2240	1	CAPACITOR,FXD, 2PF+-25PF % 500WVDC	28480	0160-2240
A5A1C16	0160-2254	1	CAPACITOR,FXD, 7.5PF+-25PF % 500WVDC	28480	0160-2254

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A1C17	0160-2258	1	CAPACITOR,FXD, 11PF+-5% 500WVDC	28480	0160-2258
A5A1C18	0121-0483		CAPACITOR, VAR, TRMR, PSTN, 5-3PF;	72982	536-016
A5A1C19	0121-0483		CAPACITOR, VAR, TRMR, PSTN, 5-3PF;	72982	536-016
A5A1L1	9100-3196	1	COIL:40 UH	28480	9100-3196
A5A1L2	9100-3195	1	COIL:50 UH	28480	9100-3195
A5A1MP1	01701-00605	2	SHIELD:SWITCH OUTER	28480	01701-00605
A5A1MP2	01701-00607	2	SHIELD:SWITCH INNER	28480	01701-00607
A5A1MP3	01701-61201	2	BRACKET ASSY:SWITCH	28480	01701-61201
A5A1MP4	1750A-64A	1	HOLDER:TRIMMER	28480	1750A-64A
A5A1R1	0757-0997	1	RESISTOR, FXD, 39.2 OHM1% .5W MF	30983	MF7C1/2-T0-39R2-F
A5A1R2	0757-0346	3	RESISTOR, FXD, 10 OHM1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A5A1R3	0698-3430	1	RESISTOR, FXD, 21.5 OHM1% .125W F	03888	PME55-1/8-T0-21R5-F
A5A1R4	0698-3431	1	RESISTOR, FXD, 23.7 OHM1% .125W F	03888	PME55-1/8-T0-23R7-F
A5A1R5	0684-0271	1	RESISTOR, FXD, 2.7 OHM10% .25W CC	01121	CB27G1
A5A1R6	0698-6400	1	RESISTOR, FXD, 900K1% .25W F TUBULAR	30983	MF52C1/4-T0-9003-F
A5A1R7	0698-6634	1	RESISTOR, FXD, 990K1% .25W F TUBULAR	30983	MF52C1/4-T9-9903-F
A5A1R8	0698-3109	1	RESISTOR, FXD, 10.1K1% .125W F TUBULAR	16299	C4-1/8-T0-1012-F
A5A1R9	0698-3429	3	RESISTOR, FXD, 19.6 OHM1% .125W F	03888	PME55-1/8-T0-19R6-F
A5A1R10	0698-5470	1	RESISTOR, FXD, 11K1% .125W F TUBULAR	24546	C4-1/8-T0-1113-F
A5A1R11	0698-3432	1	RESISTOR, FXD, 26.1 OHM1% .125W F	03888	PME55-1/8-T0-26R1-F
A5A1R12	0684-1001		RESISTOR, FXD, 10 OHM10% .25W CC	01121	CB1001
A5A1R13	0684-1001		RESISTOR, FXD, 10 OHM10% .25W CC	01121	CB1001
A5A1R14	0698-3263	1	RESISTOR, FXD, 500K1% .125W MF TUBULAR	30983	MF5C1/8-T0-5003-F
A5A1R15	0698-6654	2	RESISTOR, FXD, 800K1% .25W F TUBULAR	30983	MF4C1/8-T0-8003-F
A5A1R16	0757-0344	2	RESISTOR, FXD, 1M1% .25W F TUBULAR	24546	C5-1/4-T0-1004-F
A5A1R17	0698-4011	1	RESISTOR, FXD, 250K1% .125W F TUBULAR	16299	C4-1/8-T0-2503-F
A5A1R18	0757-0344		RESISTOR, FXD, 1M1% .25W F TUBULAR	24546	C5-1/4-T0-1004-F
A5A1R19	2100-3098		RESISTOR, VAR, 5K 20% MC SPST SW	28480	2100-3098
A5A1S1			N-S-R. PART OF MP3.		
A5A1S2	3100-3018	1	SWITCH:ROTARY 3 SECTION 9 POSITION	28480	3100-3018
A5A2	01707-63401		SAME AS A5A1, USE PREFIX A5A2.	28480	01707-63401
A5A3	01701-61616	1	ATTENUATOR ASSY (SAME AS A5A1)	28480	01701-61616
			DELAY LINE		
A5A3MP1	01701-01206	1	BRACKET:DELAY, LOWER	28480	01701-01206
A5A3MP2	01701-01207	1	BRACKET:DELAY, UPPER	28480	01701-01207
A5A4	01707-66504	1	BOARD ASSY:VERTICAL PREAMPLIFIER	50439	01707-66504
A5A4C1	0160-3443	29	CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C2	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C3	0160-2261		CAPACITOR,FXD, 15PF+-5% 500WVDC	28480	0160-2261
A5A4C4	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C5	0180-1746		CAPACITOR-FXD, 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A5A4C6	0160-2261		CAPACITOR,FXD, 15PF+-5% 500WVDC	28480	0160-2261
A5A4C7	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C8	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C9	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C10	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C11	0180-1746		CAPACITOR-FXD, 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A5A4C12	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C13	0150-0093	4	CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0150-0093
A5A4C14	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C15	0180-1746		CAPACITOR-FXD, 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A5A4C16	0150-0093		CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0150-0093
A5A4C17	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C18			NOT ASSIGNED		
A5A4C19	0180-1746		CAPACITOR-FXD, 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A5A4C20	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C21			NOT ASSIGNED		
A5A4C22	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C23	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C24	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C25	0121-0451	1	CAPACITOR, VAR, TRMR, AIR, 1.7/11PF	74970	187-0106-005
A5A4C26	0121-0455	2	CAPACITOR, VAR, TRMR, AIR, 1.9/15.7PF	74970	187-0109-005
A5A4C27	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C28	0160-2264	6	CAPACITOR,FXD, 20PF+-5% 500WVDC	28480	0160-2264
A5A4C29	0160-2264		CAPACITOR,FXD, 20PF+-5% 500WVDC	28480	0160-2264
A5A4C30	0160-2264		CAPACITOR,FXD, 20PF+-5% 500WVDC	28480	0160-2264
A5A4C31	0160-2264		CAPACITOR,FXD, 20PF+-5% 500WVDC	28480	0160-2264
A5A4C32	0180-0197	8	CAPACITOR-FXD, 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A5A4C33	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C34	0160-2202	2	CAPACITOR,FXD, 75PF+-5% 300WVDC	28480	0160-2202
A5A4C35	0160-2141		CAPACITOR,FXD, 680PF+-20% 1000WVDC	28480	0160-2141

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A4C36	0160-2141	2	CAPACITOR,FXD, 680PF+-20% 1000WVDC	28480	0160-2141
A5A4C37	0150-0059		CAPACITOR,FXD, 3.3PF+--.25PF % 500WVDC	28480	0150-0059
A5A4C38	0150-0059		CAPACITOR,FXD, 3.3PF+--.25PF % 500WVDC	28480	0150-0059
A5A4C39	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C40	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C41	0180-0161	1	CAPACITOR-FXD, 3.3UF+-20% 35VDC TA	56289	1500335X0035B2
A5A4C42	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C43	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C44	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A4C45	0150-0093		CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0150-0093
A5A4C46	0121-0455	1	CAPACITOR, VAR, TRMR, AIR, 1.9/15.7PF	74970	187-0109-005
A5A4C47	0160-2207		CAPACITOR,FXD, 300PF+-5% 300WVDC	28480	0160-2207
A5A4C48	0150-0093		CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0150-0093
A5A4C49	0160-2200	1	CAPACITOR,FXD, 43PF+-5% 300WVDC	28480	0160-2200
A5A4C50	0140-0191	2	CAPACITOR,FXD, 56PF+-5% 300WVDC	72136	DM15E56J0300WV1CR
A5A4C51	0140-0191	2	CAPACITOR,FXD, 56PF+-5% 300WVDC	72136	DM15E56J0300WV1CR
A5A4C52	0180-0197		CAPACITOR-FXD, 2.2UF+-10% 20VDC TA	56289	1500225X9020A2
A5A4C53	0180-0291		CAPACITOR-FXD, 1UF+-10% 35VDC TA-SOLID	56289	1500105X9035A2
A5A4C54	0160-3466		CAPACITOR,FXD, 100PF+-10% 250WVDC	28480	0160-3466
A5A4C55	0160-3466		CAPACITOR,FXD, 100PF+-10% 250WVDC	28480	0160-3466
A5A4C56	0160-2201		CAPACITOR,FXD, 51 PF +-5% 300WVDC	28480	0160-2201
A5A4C57	0160-3622		CAPACITOR,FXD, .10F +80-20% 100WVDC	28480	0160-3622
A5A4CR1	1901-0376	6	DIODE, GEN PRP, SI, 35V MAX VRM 50MA	28480	1901-0376
A5A4CR2	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A5A4CR3	1901-0376		DIODE, GEN PRP, SI, 35V MAX VRM 50MA	28480	1901-0376
A5A4CR4	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A5A4CR5	1901-0376		DIODE, GEN PRP, SI, 35V MAX VRM 50MA	28480	1901-0376
A5A4CR6	1901-0040	10	DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A5A4CR7	1901-0376		DIODE, GEN PRP, SI, 35V MAX VRM 50MA	28480	1901-0376
A5A4CR8	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A5A4CR9	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A5A4CR10	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A5A4CR11	1901-0040	10	DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A5A4CR12	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A5A4CR13	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A5A4CR14	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A5A4CR15	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A5A4L1	9100-2276		COIL, FXD, MOLDED RF CHOKE, 100UH 10%	24226	10/103
A5A4L2	9100-2276		COIL, FXD, MOLDED RF CHOKE, 100UH 10%	24226	10/103
A5A4L3	9100-2276		COIL, FXD, MOLDED RF CHOKE, 100UH 10%	24226	10/103
A5A4L4	9100-2276		COIL, FXD, MOLDED RF CHOKE, 100UH 10%	24226	10/103
A5A4L5	9100-2276		COIL, FXD, MOLDED RF CHOKE, 100UH 10%	24226	10/103
A5A4L6	9100-2276	2	COIL, FXD, MOLDED RF CHOKE, 100UH 10%	24226	10/103
A5A4L7	9100-2276		COIL, FXD, MOLDED RF CHOKE, 100UH 10%	24226	10/103
A5A4L8	9100-2276		COIL, FXD, MOLDED RF CHOKE, 100UH 10%	24226	10/103
A5A4L9	9100-3194		COIL:MOLDED 6.5 TURNS	28480	9100-3194
A5A4L10	9100-3194		COIL:MOLDED 6.5 TURNS	28480	9100-3194
A5A4L11	9100-2247	1	COIL, FXD, MOLDED RF CHOKE, .1UH 10%	24226	10/100
A5A4L12	9140-0158	1	COIL, FXD, MOLDED RF CHOKE, 1UH	24226	10/101
A5A401	1855-0383	2	TRANSISTOR, JFET,DUAL, N-CHAN D-MODE SI	28480	1855-0383
A5A402	1855-0383		TRANSISTOR, JFET,DUAL, N-CHAN D-MODE SI	28480	1855-0383
A5A403			NOT ASSIGNED		
A5A404		8	NOT ASSIGNED		
A5A405	1854-0345		TRANSISTOR, 2N5179 NPN SI	04713	2N5179
A5A406	1854-0345		TRANSISTOR, 2N5179 NPN SI	04713	2N5179
A5A407	1854-0345		TRANSISTOR, 2N5179 NPN SI	04713	2N5179
A5A408	1854-0345		TRANSISTOR, 2N5179 NPN SI	04713	2N5179
A5A409	1854-0345	2	TRANSISTOR, 2N5179 NPN SI	04713	2N5179
A5A4010	1854-0345		TRANSISTOR, 2N5179 NPN SI	04713	2N5179
A5A4011	1854-0345		TRANSISTOR, 2N5179 NPN SI	04713	2N5179
A5A4012	1854-0345		TRANSISTOR, 2N5179 NPN SI	04713	2N5179
A5A4013	1854-0280		TRANSISTOR, BIPOL, SI, NPN DUAL	28480	1854-0280
A5A4014	1854-0280	10	TRANSISTOR, BIPOL, SI, NPN DUAL	28480	1854-0280
A5A4015			NOT ASSIGNED		
A5A4016			NOT ASSIGNED		
A5A4017	1853-0015		TRANSISTOR, PNP SI	28480	1853-0015
A5A4018	1854-0019		TRANSISTOR, NPN SI	28480	1854-0019
A5A4019	1854-0019	6	TRANSISTOR, NPN SI	28480	1854-0019
A5A4020	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A5A4021	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A5A4022	1854-0009		TRANSISTOR, 2N709 NPN SI	28480	1854-0009
A5A4023	1854-0009		TRANSISTOR, 2N709 NPN SI	28480	1854-0009
A5A4024	1854-0009	2	TRANSISTOR, 2N709 NPN SI	28480	1854-0009
A5A4025	1854-0009		TRANSISTOR, 2N709 NPN SI	28480	1854-0009
A5A4026	1854-0009		TRANSISTOR, 2N709 NPN SI	28480	1854-0009
A5A4027	1854-0009		TRANSISTOR, 2N709 NPN SI	28480	1854-0009
A5A4028	1854-0073		TRANSISTOR, NPN SI	28480	1854-0073

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A4029	1854-0073		TRANSISTOR, NPN SI	28480	1854-0073
A5A4030	1853-0015		TRANSISTOR, PNP SI	28480	1853-0015
A5A4031	1853-0015		TRANSISTOR, PNP SI	28480	1853-0015
A5A4032	1853-0015		TRANSISTOR, PNP SI	28480	1853-0015
A5A4033	1853-0015		TRANSISTOR, PNP SI	28480	1853-0015
A5A4034	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A5A4035	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A5A4036	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A5A4037	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A5A4038	1853-0015		TRANSISTOR, PNP SI	28480	1853-0015
A5A4039	1853-0019	1	TRANSISTOR, 2N1131 PNP SI	07263	2N1131
A5A4R1	0757-0398	4	RESISTOR, FXD, 75 OHM1% .125W F TUBULAR	24546	C4-1/8-T0-75R0-F
A5A4R2	0698-4130	4	RESISTOR, FXD, 39 OHM5% .125W CC	01121	BB3905
A5A4R3	0757-0398		RESISTOR, FXD, 75 OHM1% .125W F TUBULAR	24546	C4-1/8-T0-75R0-F
A5A4R4	0684-1041		RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	CB1041
A5A4R5	0757-0469	2	RESISTOR, FXD, 150K1% .125W F TUBULAR	24546	C4-1/8-T0-1503-F
A5A4R6	0684-1041		RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	CB1041
A5A4R7	0757-0469		RESISTOR, FXD, 150K1% .125W F TUBULAR	24546	C4-1/8-T0-1503-F
A5A4R8	0684-1041		RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	CB1041
A5A4R9	0684-1221		RESISTOR, FXD, 1.2K10% .25W CC TUBULAR	01121	CB1221
A5A4R10	0684-1041		RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	CB1041
A5A4R11	0684-1221		RESISTOR, FXD, 1.2K10% .25W CC TUBULAR	01121	CB1221
A5A4R12	0698-4130		RESISTOR, FXD, 39 OHM5% .125W CC	01121	BB3905
A5A4R13	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A5A4R14	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A5A4R15	0757-0438		RESISTOR, FXD, 5.11K1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A5A4R16	0757-0438		RESISTOR, FXD, 5.11K1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A5A4R17	0757-0438		RESISTOR, FXD, 5.11K1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A5A4R18	0757-0438		RESISTOR, FXD, 5.11K1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A5A4R19	0684-3901	45	RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A5A4R20	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A5A4R21	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A5A4R22	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A5A4R23	0757-0346		RESISTOR, FXD, 10 OHM1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A5A4R24	0757-0430	4	RESISTOR, FXD, 2.21K1% .125W F TUBULAR	24546	C4-1/8-T0-2211-F
A5A4R25	0757-0430		RESISTOR, FXD, 2.21K1% .125W F TUBULAR	24546	C4-1/8-T0-2211-F
A5A4R26	0757-0346		RESISTOR, FXD, 10 OHM1% .125W F TUBULAR	24546	C4-1/8-T0-10R0-F
A5A4R27	0757-0430		RESISTOR, FXD, 2.21K1% .125W F TUBULAR	24546	C4-1/8-T0-2211-F
A5A4R28	0757-0430		RESISTOR, FXD, 2.21K1% .125W F TUBULAR	24546	C4-1/8-T0-2211-F
A5A4R29	0684-8201	4	RESISTOR, FXD, 82 OHM10% .25W CC	01121	CB8201
A5A4R30	0684-8201		RESISTOR, FXD, 82 OHM10% .25W CC	01121	CB8201
A5A4R31	0684-1041		RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	CB1041
A5A4R32	0684-8201		RESISTOR, FXD, 82 OHM10% .25W CC	01121	CB8201
A5A4R33	0684-8201		RESISTOR, FXD, 82 OHM10% .25W CC	01121	CB8201
A5A4R34	0698-3155	4	RESISTOR, FXD, 4.64K1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A5A4R35	0698-3155		RESISTOR, FXD, 4.64K1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A5A4R36	0698-3155		RESISTOR, FXD, 4.64K1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A5A4R37	0698-3155		RESISTOR, FXD, 4.64K1% .125W F TUBULAR	16299	C4-1/8-T0-4641-F
A5A4R38	0757-0284	6	RESISTOR, FXD, 150 OHM1% .125W F	24546	C4-1/8-T0-151-F
A5A4R39	0757-0284		RESISTOR, FXD, 150 OHM1% .125W F	24546	C4-1/8-T0-151-F
A5A4R40	0757-0388	2	RESISTOR, FXD, 30.1 OHM1% .125W F	24546	C4-1/8-T0-30R1-F
A5A4R41	0757-0388		RESISTOR, FXD, 30.1 OHM1% .125W F	24546	C4-1/8-T0-30R1-F
A5A4R42	0698-3434	2	RESISTOR, FXD, 34.8 OHM1% .125W F	16299	C4-1/8-T0-34R8-F
A5A4R43	2100-2574	3	RESISTOR, VAR, TRMR, 500 OHM 10% C	19701	FT50X501
A5A4R44	0684-1001		RESISTOR, FXD, 10 OHM10% .25W CC	01121	CB1001
A5A4R45	0698-3434		RESISTOR, FXD, 34.8 OHM1% .125W F	16299	C4-1/8-T0-34R8-F
A5A4R46	2100-2574		RESISTOR, VAR, TRMR, 500 OHM 10% C	19701	FT50X501
A5A4R47	0684-1001		RESISTOR, FXD, 10 OHM10% .25W CC	01121	CB1001
A5A4R48	0684-1021		RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	CB1021
A5A4R49	0684-1021		RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	CB1021
A5A4R50	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A5A4R51	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A5A4R52	0698-0085		RESISTOR, FXD, 2.61K 1% .125W F TUBULAR	16299	C4-1/8-T0-2611-F
A5A4R53	0698-0085		RESISTOR, FXD, 2.61K 1% .125W F TUBULAR	16299	C4-1/8-T0-2611-F
A5A4R54	0757-0284		RESISTOR, FXD, 150 OHM1% .125W F	24546	C4-1/8-T0-151-F
A5A4R55	0684-2211		RESISTOR, FXD, 220 OHM10% .25W CC	01121	CB2211
A5A4R56	0684-2211		RESISTOR, FXD, 220 OHM10% .25W CC	01121	CB2211
A5A4R57	0757-0392	1	RESISTOR, FXD, 43.2 OHM1% .125W F	24546	C4-1/8-T0-43R2-F
A5A4R58	0757-0440		RESISTOR, FXD, 7.5K1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A5A4R59			NOT ASSIGNED		
A5A4R60	0757-0440		RESISTOR, FXD, 7.5K1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A5A4R61	0757-0440		RESISTOR, FXD, 7.5K1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A5A4R62			NOT ASSIGNED		
A5A4R63	0757-0440		RESISTOR, FXD, 7.5K1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A5A4R64	0757-0417		RESISTOR, FXD, 562 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-562R-F

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A4R65	0684-1021	2	RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	CB1021
A5A4R66	2100-1986		RESISTOR, VAR, TRMR, 1KOHM 10% C	28480	2100-1986
A5A4R67	0684-1011	4	RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A5A4R68	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A5A4R69	0757-0433		RESISTOR, FXD, 3.32K1% .125W F TUBULAR	24546	C4-1/8-T0-3321-F
A5A4R70	2100-1986		RESISTOR, VAR, TRMR, 1KOHM 10% C	28480	2100-1986
A5A4R71	0757-0433	3	RESISTOR, FXD, 3.32K1% .125W F TUBULAR	24546	C4-1/8-T0-3321-F
A5A4R72	0684-1021		RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	CB1021
A5A4R73	0684-1021		RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	CB1021
A5A4R74	0757-0421		RESISTOR, FXD, 825 OHM1% .125W F	24546	C4-1/8-T0-825R-F
A5A4R75	0757-0408		RESISTOR, FXD, 243 OHM1% .125W F	24546	C4-1/8-T0-243R-F
A5A4R76	0757-0408		RESISTOR, FXD, 243 OHM1% .125W F	24546	C4-1/8-T0-243R-F
A5A4R77	0757-0421	1	RESISTOR, FXD, 825 OHM1% .125W F	24546	C4-1/8-T0-825R-F
A5A4R78	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A5A4R79	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A5A4R80	0757-0284	1	RESISTOR, FXD, 150 OHM1% .125W F	24546	C4-1/8-T0-151-F
A5A4R81	2100-1738		RESISTOR, VAR, TRMR, 500 OHM 10% C	28480	2100-1738
A5A4R82	0757-0931	1	RESISTOR, FXD, 2K2% .125W F TUBULAR	24546	C4-1/8-T0-2001-G
A5A4R83	0684-2211		RESISTOR, FXD, 220 OHM10% .25W CC	01121	CB2211
A5A4R84	0684-2211		RESISTOR, FXD, 220 OHM10% .25W CC	01121	CB2211
A5A4R85	0684-1011	2	RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A5A4R86	0757-0451		RESISTOR, FXD, 24.3K1% .125W F TUBULAR	24546	C4-1/8-T0-2432-F
A5A4R87	0757-0451	1	RESISTOR, FXD, 24.3K1% .125W F TUBULAR	24546	C4-1/8-T0-2432-F
A5A4R88	0757-0398		RESISTOR, FXD, 75 OHM1% .125W F TUBULAR	24546	C4-1/8-T0-75R0-F
A5A4R89	0757-0399		RESISTOR, FXD, 82.5 OHM1% .125W F	24546	C4-1/8-T0-82R5-F
A5A4R90	0757-0398	1	RESISTOR, FXD, 75 OHM1% .125W F TUBULAR	24546	C4-1/8-T0-75R0-F
A5A4R91	0757-0415		RESISTOR, FXD, 475 OHM1% .125W F	24546	C4-1/8-T0-475R-F
A5A4R92	2100-2574	2	RESISTOR, VAR, TRMR, 500 OHM 10% C	19701	ET50X501
A5A4R93	0757-0418		RESISTOR, FXD, 619 OHM1% .125W F	24546	C4-1/8-T0-619R-F
A5A4R94	0757-0400	8	RESISTOR, FXD, 90.9 OHM1% .125W F	24546	C4-1/8-T0-90R9-F
A5A4R95	0757-0284	1	RESISTOR, FXD, 150 OHM1% .125W F	24546	C4-1/8-T0-151-F
A5A4R96	2100-2031		RESISTOR, VAR, TRMR, 50KOHM 10% C	28480	2100-2031
A5A4R97	0757-0284	5	RESISTOR, FXD, 150 OHM1% .125W F	24546	C4-1/8-T0-151-F
A5A4R98	0757-0420		RESISTOR, FXD, 750 OHM1% .125W F	24546	C4-1/8-T0-751-F
A5A4R99	0757-0400		NOT ASSIGNED		
A5A4R100	0757-0400	1	RESISTOR, FXD, 90.9 OHM1% .125W F	24546	C4-1/8-T0-90R9-F
A5A4R101	0757-0400		RESISTOR, FXD, 90.9 OHM1% .125W F	24546	C4-1/8-T0-90R9-F
A5A4R102	0684-1231	1	RESISTOR, FXD, 12K	01121	CB4731
A5A4R103	0683-5115		RESISTOR, FXD, 510 OHM5% .25W CC	01121	CB5115
A5A4R104	0684-1231		RESISTOR, FXD, 12K	01121	CB1531
A5A4R105	0684-3321	7	RESISTOR, FXD, 3.3K10% .25W CC TUBULAR	01121	CB3321
A5A4R106	0684-3321		RESISTOR, FXD, 3.3K10% .25W CC TUBULAR	01121	CB3321
A5A4R107	0684-2221	1	RESISTOR, FXD, 2.2K10% .25W CC TUBULAR	01121	CB2221
A5A4R108	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A5A4R109	0684-4721		RESISTOR, FXD, 4.7K10% .25W CC TUBULAR	01121	CB4721
A5A4R110	0684-4721	2	RESISTOR, FXD, 4.7K10% .25W CC TUBULAR	01121	CB4721
A5A4R111	0757-0421		RESISTOR, FXD, 825 OHM1% .125W F	24546	C4-1/8-T0-825R-F
A5A4R112	0757-0290	4	RESISTOR, FXD, 6.19K1% .125W F TUBULAR	30983	MF4C1/8-T0-6191-F
A5A4R115	0684-1021		RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	CB1021
A5A4R116	0757-0283	2	RESISTOR, FXD, 2K1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A5A4R117	0684-5621		RESISTOR, FXD, 5.6K10% .25W CC TUBULAR	01121	CB5621
A5A4R118	0684-5621	1	RESISTOR, FXD, 5.6K10% .25W CC TUBULAR	01121	CB5621
A5A4R119	0684-3321		RESISTOR, FXD, 3.3K10% .25W CC TUBULAR	01121	CB3321
A5A4R120	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A5A4R121	0684-3311	1	RESISTOR, FXD, 330 OHM10% .25W CC	01121	CB3311
A5A4R122	0757-0400		RESISTOR, FXD, 90.9 OHM1% .125W F	24546	C4-1/8-T0-90R9-F
A5A4R123	0757-0400	1	RESISTOR, FXD, 90.9 OHM1% .125W F	24546	C4-1/8-T0-90R9-F
A5A4R124	0757-0965		RESISTOR, FXD, 51K 2% .125W F TUBULAR	24546	C4-1/8-T0-5102-G
A5A4U1	1820-0094	1	INTEGRATED CIRCUIT, DTL, DTL QUAD 2	04713	MC846P
A5A4U2	1820-0308		INTEGRATED CIRCUIT, DTL, DTL CLOCKED	01295	SN15845N
A5A4VR1	1902-3059	1	DIODE, VREG, 3.83V VZ, .4W MAX	28480	1902-3059
A5A4VR2	1902-3104		DIODE, VREG, 5.62V VZ, .4W MAX	28480	1902-3104
A5A4XU1	1200-0768	9	SOCKET, FLEC, IC 14-CONT DIP SLDR TERM	91506	314-AG50-3R
A5A4XU2	1200-0768		SOCKET, FLEC, IC 14-CONT DIP SLDR TERM	91506	314-AG50-3R
A5A5	01707-66502	1	BOARD ASSY:VERTICAL OUTPUT	28480	01707-66502
A5A5C1	0160-3443	1	CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A5C2	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A5C3	0160-2262	2	CAPACITOR,FXD, 16PF+-5% 500WVDC	28480	0160-2262
A5A5C4	0160-0157		CAPACITOR,FXD, .0047UF+-10% 200WVDC	56289	292P47292
A5A5C5	0180-0376	1	CAPACITOR-FXD, .47UF+-10% 35VDC TA	56289	1500474X9035A2
A5A5C6	0160-0157		CAPACITOR,FXD, .0047UF+-10% 200WVDC	56289	292P47292
A5A5C7	0121-0166	2	CAPACITOR, VAR, TRMR, AIR, 2.4/24.5PF	74970	189-0509-005

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5A5C8	0160-3443	2	CAPACITOR, FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A5C9	0160-2251		CAPACITOR, FXD, 5.6PF+- .25PF $\pm$ 500WVDC	28480	0160-2251
A5A5C10	0160-2251	1	CAPACITOR, FXD, 5.6PF+- .25PF $\pm$ 500WVDC	28480	0160-2251
A5A5C11	0140-0199		CAPACITOR, FXD, 240PF+-5% 300WVDC	72136	DM15F241J0300WV1CR
A5A5C12	0121-0166		CAPACITOR, VAR. TRMR, AIR, 2.4/24.5PF	74970	189-0509-005
A5A5C13	0160-3443		CAPACITOR, FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A5C14	0160-2263	1	CAPACITOR, FXD, 18PF+-5% 500WVDC	28480	0160-2263
A5A5C15	0160-3443		CAPACITOR, FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A5C16	0160-3443		CAPACITOR, FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A5A5L1	9100-2276		COIL, FXD, MOLDED RF CHOKE, 100UH 10%	24226	10/103
A5A5L2	9100-2276	2	COIL, FXD, MOLDED RF CHOKE, 100UH 10%	24226	10/103
A5A5L3	9100-2254		COIL, FXD, MOLDED RF CHOKE, .39UH 10%	24226	10/390
A5A5L4	9100-2254	4	COIL, FXD, MOLDED RF CHOKE, .39UH 10%	24226	10/390
A5A501	1854-0354		TRANSISTOR, NPN SI	28480	1854-0354
A5A502	1854-0354		TRANSISTOR, NPN SI	28480	1854-0354
A5A503	1853-0036	2	TRANSISTOR, PNP SI	28480	1853-0036
A5A504	1854-0354		TRANSISTOR, NPN SI	28480	1854-0354
A5A505	1854-0354		TRANSISTOR, NPN SI	28480	1854-0354
A5A506	1854-0233		TRANSISTOR, 2N3866 NPN SI	02735	2N3866
A5A507	1854-0233		TRANSISTOR, 2N3866 NPN SI	02735	2N3866
A5A508	1854-0359		TRANSISTOR, NPN SI	28480	1854-0359
A5A509	1854-0359	2	TRANSISTOR, NPN SI	28480	1854-0359
A5A5R1	0757-0400		RESISTOR, FXD, 90.9 OHM1% .125W F	24546	C4-1/8-T0-90R9-F
A5A5R2	0757-0400		RESISTOR, FXD, 90.9 OHM1% .125W F	24546	C4-1/8-T0-90R9-F
A5A5R3	0757-0400		RESISTOR, FXD, 90.9 OHM1% .125W F	24546	C4-1/8-T0-90R9-F
A5A5R4	0757-0420	4	RESISTOR, FXD, 750 OHM1% .125W F	24546	C4-1/8-T0-751-F
A5A5R5	0757-0290		RESISTOR, FXD, 6.19K1% .125W F TUBULAR	30983	MF4C1/8-T0-6191-F
A5A5R6	0757-0420		RESISTOR, FXD, 750 OHM1% .125W F	24546	C4-1/8-T0-751-F
A5A5R7	0757-0180		RESISTOR, FXD, 31.6 OHM1% .125W F	24546	C5-1/4-T0-31R6-F
A5A5R8	0757-0410	3	RESISTOR, FXD, 301 OHM1% .125W F	24546	C4-1/8-T0-301R-F
A5A5R9	0757-0180	2	RESISTOR, FXD, 31.6 OHM1% .125W F	24546	C5-1/4-T0-31R6-F
A5A5R10	0757-0433		RESISTOR, FXD, 3.32K1% .125W F TUBULAR	24546	C4-1/8-T0-3321-F
A5A5R11	0757-0433		RESISTOR, FXD, 3.32K1% .125W F TUBULAR	24546	C4-1/8-T0-3321-F
A5A5R12	0757-0416		RESISTOR, FXD, 511 OHM1% .125W F	24546	C4-1/8-T0-511R-F
A5A5R13	0757-0442	2	RESISTOR, FXD, 10K1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A5A5R14	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CR3901
A5A5R15	0698-3159		RESISTOR, FXD, 26.1K1% .125W F TUBULAR	16299	C4-1/8-T0-2612-F
A5A5R16	0757-0416		RESISTOR, FXD, 511 OHM1% .125W F	24546	C4-1/8-T0-511R-F
A5A5R17	0684-1001	2	RESISTOR, FXD, 10 OHM10% .25W CC	01121	CR1001
A5A5R18	0757-0442		RESISTOR, FXD, 10K1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A5A5R19	0684-1001	1	RESISTOR, FXD, 10 OHM10% .25W CC	01121	CR1001
A5A5R20	0757-0411		RESISTOR, FXD, 332 OHM1% .125W F	24546	C4-1/8-T0-332R-F
A5A5R21	0757-0420		RESISTOR, FXD, 750 OHM1% .125W F	24546	C4-1/8-T0-751-F
A5A5R22	0757-0420		RESISTOR, FXD, 750 OHM1% .125W F	24546	C4-1/8-T0-751-F
A5A5R23	0684-2201	2	RESISTOR, FXD, 22 OHM10% .25W CC	01121	CR2201
A5A5R24	0757-0802	2	RESISTOR, FXD, 162 OHM1% .5W MF TUBULAR	30983	MF7C-1/2-T0-162R-F
A5A5R25	0757-0802		RESISTOR, FXD, 162 OHM1% .5W MF TUBULAR	30983	MF7C-1/2-T0-162R-F
A5A5R26	0684-2201		RESISTOR, FXD, 22 OHM10% .25W CC	01121	CR2201
A5A5R27	0698-3429		RESISTOR, FXD, 19.6 OHM1% .125W F	03888	PME55-1/8-T0-19R6-F
A5A5R28	0698-3429	5	RESISTOR, FXD, 19.6 OHM1% .125W F	03888	PME55-1/8-T0-19R6-F
A5A5R29	0757-0280		RESISTOR, FXD, 1K1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A5A5R30	2100-2061		RESISTOR, VAR. TRMR, 200 OHM 10% C	28480	2100-2061
A5A5R31	0757-0401		RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A5A5R32	0698-5563	2	RESISTOR, FXD, 180 OHM5% .125W CC	01121	BR1815
A5A5R33	0698-5563		RESISTOR, FXD, 180 OHM5% .125W CC	01121	BR1815
A5A5R34	0757-0814	4	RESISTOR, FXD, 511 OHM1% .5W MF TUBULAR	30983	MF7C1/2-T0-511R-F
A5A5R35	0757-0814		RESISTOR, FXD, 511 OHM1% .5W MF TUBULAR	30983	MF7C1/2-T0-511R-F
A5A5R36	0757-0814		RESISTOR, FXD, 511 OHM1% .5W MF TUBULAR	30983	MF7C1/2-T0-511R-F
A5A5R37	0757-0814		RESISTOR, FXD, 511 OHM1% .5W MF TUBULAR	30983	MF7C1/2-T0-511R-F
A5A5R38	0757-0180	2	RESISTOR, FXD, 31.6 OHM1% .125W F	24546	C5-1/4-T0-31R6-F
A5A5R39	0757-0180		RESISTOR, FXD, 31.6 OHM1% .125W F	24546	C5-1/4-T0-31R6-F
A6	01707-65812	1	HORIZONTAL AMPLIFIER MODULE ASSY	28480	01707-65812
A6R1	2100-1841	2	RESISTOR, VAR. CONT, 100K 20% CC	28480	2100-1841
A6R2	2100-1841		RESISTOR, VAR. CONT, 100K 20% CC	28480	2100-1841
A6R3	2100-3082	1	RESISTOR, VAR. CONT, PREC, 2K 3% WW	28480	2100-3082
A6R4	2100-3009	2	RESISTOR, VAR. 20K 20% DPST SW	28480	2100-3009
A6R5	2100-3009	1	RESISTOR, VAR. 20K 20% DPST SW	28480	2100-3009
A6R6	2100-3014		RESISTOR, VAR. CNTRC, 20K/20K 20% CC	28480	2100-3014
A6R7	2100-3015		RESISTOR, VAR. 200K 20% SPST SW	28480	2100-3015
A6R8	0757-0407		RESISTOR, FXD, 200 OHM1% .125W F	24546	C4-1/8-T0-201-F
A6R9	0757-0435	1	RESISTOR, FXD, 3.92K 1% .125W F TUBULAR	24546	C4-1/8-T0-3921-F
A6R10	0757-0283		RESISTOR, FXD, 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A6R11	0757-0435		RESISTOR, FXD, 3.92K 1% .125W F TUBULAR	24546	C4-1/8-T0-3921-F
A6R12	0757-0283		RESISTOR, FXD, 2K 1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A1	01701-66558	1			
A6A1C1 A6A1C2	0160-2207		CAPACITOR, FXD, 300PF $\pm$ 5% 300WVDC NOT ASSIGNED	28480	0160-2207
A6A1C3	0180-0094	1	CAPACITOR-FXD, 100UF+75-10% 25VDC AL	56289	300107G0250D2
A6A101	1854-0087	1	TRANSISTOR, NPN SI	28480	1854-0087
A6A1R1	0684-1041		RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	C81041
A6A1R2	0684-1041		RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	C81041
A6A1R3	0684-6821	1	RESISTOR, FXD, 6.8K10% .25W CC TUBULAR	01121	C86821
A6A1R4 A6A1R5	0757-0418		RESISTOR, FXD, 619 OHM1% .125W F NOT ASSIGNED	24546	C4-1/8-T0-619R-F
A6A1R6	0757-0413	1	RESISTOR, FXD, 392 OHM1% .125W F	24546	C4-1/8-T0-392R-F
A6A1R7	0684-2221		RESISTOR, FXD, 2.2K10% .25W CC TUBULAR	01121	C82221
A6A1R8	0684-3331		RESISTOR, FXD, 33K 10% .25W CC TUBULAR	01121	C83331
A6A1R9	0757-0407		RESISTOR, FXD, 200 OHM1% .125W F	24546	C4-1/8-T0-201-F
A6A1R10	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	C81031
A6A1R11	0684-2231		RESISTOR, FXD, 22K 10% CC TUBULAR	01121	C82231
A6A1R12	0757-0273		RESISTOR, FXD, 3.01K 1% F TUBULAR	24546	C4-1/8-T0-3011-F
A6A1S1	3101-1399	4	SWITCH: PUSHBUTTON 2 POLE 4 STATION	28480	3101-1399
A6A1S2	3101-1400	3	SWITCH, PB 1-STA MODULE DPDT	28480	3101-1400
A6A1S3	3101-1399		SWITCH: PUSHBUTTON 2 POLE 4 STATION	28480	3101-1399
A6A1S4	3101-1399		SWITCH: PUSHBUTTON 2 POLE 4 STATION	28480	3101-1399
A6A1S5	3101-1399		SWITCH: PUSHBUTTON 2 POLE 4 STATION	28480	3101-1399
A6A1XA1 A6A1XA2 A6A1XA3	1251-1626	6	NOT ASSIGNED NOT ASSIGNED CONNECTOR, PC EDGE, 12-CONT, DIP SOLDER	71785	252-12-30-300
A6A1XA4	1251-1626		CONNECTOR, PC EDGE, 12-CONT, DIP SOLDER	71785	252-12-30-300
A6A1XA5	1251-1626		CONNECTOR, PC EDGE, 12-CONT, DIP SOLDER	71785	252-12-30-300
A6A1XA6	1251-1626		CONNECTOR, PC EDGE, 12-CONT, DIP SOLDER	71785	252-12-30-300
A6A1XA7	1251-1626		CONNECTOR, PC EDGE, 12-CONT, DIP SOLDER	71785	252-12-30-300
A6A1XA8	1251-1626		CONNECTOR, PC EDGE, 12-CONT, DIP SOLDER	71785	252-12-30-300
A6A2	01701-66552	1	BOARD ASSY: TRIGGER	28480	01701-66552
A6A2C1	0150-0070	1	CAPACITOR, FXD, .02UF $\pm$ 20% 500WVDC	28480	0150-0070
A6A2C2	0140-0203	4	CAPACITOR, FXD, 30PF $\pm$ 5% 500WVDC	72136	DM15E300J0500WV1CR
A6A2C3	0160-3451		CAPACITOR, FXD, .01UF $\pm$ 80-20% 100WVDC	28480	0160-3451
A6A2C4	0160-3452		CAPACITOR, FXD, .02UF $\pm$ 20% 100WVDC	28480	0160-3452
A6A2C5	0140-0203		CAPACITOR, FXD, 30PF $\pm$ 5% 500WVDC	72136	DM15E300J0500WV1CR
A6A2C6	0160-3451		CAPACITOR, FXD, .01UF $\pm$ 80-20% 100WVDC	28480	0160-3451
A6A2C7	0160-3453		CAPACITOR, FXD, .05UF $\pm$ 80-20% 100WVDC	28480	0160-3453
A6A2C8	0160-3453		CAPACITOR, FXD, .05UF $\pm$ 80-20% 100WVDC	28480	0160-3453
A6A2C9	0160-3453		CAPACITOR, FXD, .05UF $\pm$ 80-20% 100WVDC	28480	0160-3453
A6A2C10	0160-3453		CAPACITOR, FXD, .05UF $\pm$ 80-20% 100WVDC	28480	0160-3453
A6A2C11	0180-0197		CAPACITOR-FXD, 2.2UF $\pm$ 10% 20VDC TA	56289	1500225X9020A2
A6A2C12	0160-2204		CAPACITOR, FXD, 100PF $\pm$ 5% 300WVDC	28480	0160-2204
A6A2C13	0160-3453		CAPACITOR, FXD, .05UF $\pm$ 80-20% 100WVDC	28480	0160-3453
A6A2C14	0160-3453		CAPACITOR, FXD, .05UF $\pm$ 80-20% 100WVDC	28480	0160-3453
A6A2C15	0160-3453		CAPACITOR, FXD, .05UF $\pm$ 80-20% 100WVDC	28480	0160-3453
A6A2C16	0160-3453		CAPACITOR, FXD, .05UF $\pm$ 80-20% 100WVDC	28480	0160-3453
A6A2C17	0160-2914	1	CAPACITOR, FXD, .1UF $\pm$ 80-20% 50WVDC	28480	0160-2914
A6A2CR1	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A2CR2	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A2CR3	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A2CR4	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A2CR5	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A2CR6	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A2CR7	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A2CR8	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A2CR9	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A2CR10	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A2CR11	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A2CR12	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A2CR13	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A201	1855-0085	2	TSTR:FET (MATCHED PAIR)	28480	1855-0085
A6A202	1854-0296	12	P/O OF MATCHED PAIR LISTED UNDER A6A201	28480	1854-0296
A6A203	1854-0296		TRANSISTOR, NPN SI	28480	1854-0296
A6A204	1854-0296		TRANSISTOR, NPN SI	28480	1854-0296
A6A205	1854-0296		TRANSISTOR, NPN SI	28480	1854-0296
A6A206	1854-0296		TRANSISTOR, NPN SI	28480	1854-0296
A6A207	1853-0015		TRANSISTOR, PNP SI	28480	1853-0015
A6A208	1853-0015		TRANSISTOR, PNP SI	28480	1853-0015
A6A209	1855-0085		TSTR:FET (MATCHED PAIR)	28480	1855-0085
A6A2010			P/O OF MATCHED PAIR LISTED UNDER A6A209	28480	1854-0296
A6A2011	1854-0296		TRANSISTOR, NPN SI	28480	1854-0296
A6A2012	1854-0296		TRANSISTOR, NPN SI	28480	1854-0296
A6A2013	1854-0296		TRANSISTOR, NPN SI	28480	1854-0296
A6A2014	1854-0296		TRANSISTOR, NPN SI	28480	1854-0296

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A2Q15	1853-0015	5	TRANSISTOR, PNP SI	28480	1853-0015
A6A2Q16	1853-0015		TRANSISTOR, PNP SI	28480	1853-0015
A6A2Q17	1854-0296		TRANSISTOR, NPN SI	28480	1854-0296
A6A2Q18	1854-0296		TRANSISTOR, NPN SI	28480	1854-0296
A6A2Q19	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A2Q20	1853-0036	5	TRANSISTOR, PNP SI	28480	1853-0036
A6A2Q21	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A2Q22	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A2Q23	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A6A2Q24	1853-0049		TRANSISTOR, PNP SI	28480	1853-0049
A6A2Q25	1853-0049	2	TRANSISTOR, PNP SI	28480	1853-0049
A6A2Q26	1853-0049		TRANSISTOR, PNP SI	28480	1853-0049
A6A2Q27	1854-0296		TRANSISTOR, NPN SI	28480	1854-0296
A6A2Q28	1854-0296		TRANSISTOR, NPN SI	28480	1854-0296
A6A2Q29	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A2R1	0684-1041	2	RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	CB1041
A6A2R2	0757-0367		RESISTOR, FXD, 100K1% .5W MF TUBULAR	30983	MF7C1/2-T0-1003-F
A6A2R3	0757-0488		RESISTOR, FXD, 909K1% .125W MF TUBULAR	28480	0757-0488
A6A2R4	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R5	0757-0442		RESISTOR, FXD, 10K1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A6A2R6	0684-3901	2	RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R7	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A6A2R8	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R9	0684-3321		RESISTOR, FXD, 3.3K10% .25W CC TUBULAR	01121	CB3321
A6A2R10	0757-0401		RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A6A2R11	0684-2221	2	RESISTOR, FXD, 2.2K10% .25W CC TUBULAR	01121	CB2221
A6A2R12	0757-0401		RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A6A2R13	0757-0273		RESISTOR, FXD, 3.01K1% .125W F TUBULAR	24546	C4-1/8-T0-3011-F
A6A2R14	0757-0410		RESISTOR, FXD, 301 OHM1% .125W F	24546	C4-1/8-T0-301R-F
A6A2R15	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R16	0757-0442	2	RESISTOR, FXD, 10K1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A6A2R17	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R18	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A6A2R19	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R20	0757-0401		RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A6A2R21	0757-0401	2	RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A6A2R22	0757-0367		RESISTOR, FXD, 100K1% .5W MF TUBULAR	30983	MF7C1/2-T0-1003-F
A6A2R23	0757-0488		RESISTOR, FXD, 909K1% .125W MF TUBULAR	28480	0757-0488
A6A2R24	0698-4130		RESISTOR, FXD, 39 OHM5% .125W CC	01121	BB3905
A6A2R25	0757-0442		RESISTOR, FXD, 10K1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A6A2R26	0684-3901	2	RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R27	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A6A2R28	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R29	0684-3321		RESISTOR, FXD, 3.3K10% .25W CC TUBULAR	01121	CB3321
A6A2R30	0757-0401		RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A6A2R31	0684-2221	2	RESISTOR, FXD, 2.2K10% .25W CC TUBULAR	01121	CB2221
A6A2R32	0757-0401		RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A6A2R33	0757-0273		RESISTOR, FXD, 3.01K1% .125W F TUBULAR	24546	C4-1/8-T0-3011-F
A6A2R34	0757-0410		RESISTOR, FXD, 301 OHM1% .125W F	24546	C4-1/8-T0-301R-F
A6A2R35	0698-4130		RESISTOR, FXD, 39 OHM5% .125W CC	01121	BB3905
A6A2R36	0757-0442	2	RESISTOR, FXD, 10K1% .125W F TUBULAR	24546	C4-1/8-T0-1002-F
A6A2R37	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R38	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A6A2R39	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R40	0757-0401		RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A6A2R41	0757-0401	2	RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A6A2R42	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R43	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R44	0684-2221		RESISTOR, FXD, 2.2K10% .25W CC TUBULAR	01121	CB2221
A6A2R45	0757-0401		RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A6A2R46	2100-2216	2	RESISTOR, VAR, TRMR, 5KOHM 10% C	28480	2100-2216
A6A2R47	0757-0429		RESISTOR, FXD, 1.82K1% .125W F TUBULAR	24546	C4-1/8-T0-1821-F
A6A2R48	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R49	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A2R50	0757-0401		RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A6A2R51	0757-0438	7	RESISTOR, FXD, 5.11K1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A6A2R52	0684-2231		RESISTOR, FXD, 22K10% .25W CC TUBULAR	01121	CB2231
A6A2R53	0684-1531		RESISTOR, FXD, 15K10% .25W CC TUBULAR	01121	CB1531
A6A2R54	0684-3341		RESISTOR, FXD, 330K10% .25W CC TUBULAR	01121	CB3341
A6A2R55	0684-2221		RESISTOR, FXD, 2.2K10% .25W CC TUBULAR	01121	CB2221
A6A2R56	0757-0465	7	RESISTOR, FXD, 100K1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A6A2R57	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A6A2R58	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A2R59	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A6A2R60	0684-3321		RESISTOR, FXD, 3.3K10% .25W CC TUBULAR	01121	CB3321

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A2R61	0684-2221		RESISTOR, FXD, 2.2K10% .25W CC TUBULAR	01121	C82221
A6A2R62	0757-0401		RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A6A2R63	2100-2216		RESISTOR, VAR, TRMR, 5KOHM 10% C	28480	2100-2216
A6A2R64	0757-0429		RESISTOR, FXD, 1.82K1% .125W F TUBULAR	24546	C4-1/8-T0-1821-F
A6A2R65	0757-0401		RESISTOR, FXD, 100 OHM1% .125W F	24546	C4-1/8-T0-101-F
A6A2R66	0757-0438		RESISTOR, FXD, 5.11K1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A6A2R67	0684-1001		RESISTOR, FXD, 10 OHM10% .25W CC	01121	C81001
A6A2R68	0684-1001		RESISTOR, FXD, 10 OHM10% .25W CC	01121	C81001
A6A2R69	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	C83901
A6A2R70	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	C83901
A6A2R71			NOT ASSIGNED		
A6A2R72	0757-0465		RESISTOR, FXD, 100K1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A6A2R73	0757-0465		RESISTOR, FXD, 100K1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A6A2R74	0757-0401		RESISTOR, FXD, 100 OHM, 1% .125W F	24546	C4-1/8-T0-101-F
A6A2S1	3101-1705	7	SWITCH, PB -STA DPDT	28480	3101-1705
A6A2S2	3101-1705		SWITCH, PB -STA DPDT	28480	3101-1705
A6A2S3	3101-1705		SWITCH, PB -STA DPDT	28480	3101-1705
A6A2S4	3101-1400		SWITCH, PB 1-STA MODULE DPDT	28480	3101-1400
A6A2S5	3101-1705		SWITCH, PB -STA DPDT	28480	3101-1705
A6A2S6	3101-1705		SWITCH, PB -STA DPDT	28480	3101-1705
A6A2S7	3101-1400		SWITCH, PB 1-STA MODULE DPDT	28480	3101-1400
A6A2S8	3101-1705		SWITCH, PB -STA DPDT	28480	3101-1705
A6A2S9	3101-1705		SWITCH, PB -STA DPDT	28480	3101-1705
A6A2U1	1820-0142	2	INTEGRATED CIRCUIT, DCTL, ECL DUAL 4	04713	MC1004P
A6A2U2	1820-0142		INTEGRATED CIRCUIT, DCTL, ECL DUAL 4	04713	MC1004P
A6A2XU1	1200-0768		SOCKET, ELEC, IC 14-CONT DIP SLDR TERM	91506	314-AG50-3R
A6A2XU2	1200-0768		SOCKET, ELEC, IC 14-CONT DIP SLDR TERM	91506	314-AG50-3R
A6A3	01701-66514	2	BOARD ASSY: INTEGRATOR	28480	01701-66514
A6A3C1	0180-0230		CAPACITOR-FXD, 1UF+-20% 50VDC TA-SOLID	56289	1500105X0050A2
A6A3C2	0180-0230		CAPACITOR-FXD, 1UF+-20% 50VDC TA-SOLID	56289	1500105X0050A2
A6A3C3	0180-0230		CAPACITOR-FXD, 1UF+-20% 50VDC TA-SOLID	56289	1500105X0050A2
A6A3C4	0180-0230		CAPACITOR-FXD, 1UF+-20% 50VDC TA-SOLID	56289	1500105X0050A2
A6A3C5	0160-3451		CAPACITOR-FXD, .01UF+-20% 100WVDC	28480	0160-3451
A6A3C6	0160-3451		CAPACITOR-FXD, .01UF+-20% 100WVDC	28480	0160-3451
A6A3C7	0160-3448	2	CAPACITOR-FXD, .001UF+-10% 1000WVDC	28480	0160-3448
A6A3C8	0160-2264		CAPACITOR-FXD, 20PF+-5% 500WVDC	28480	0160-2264
A6A3C9	0160-3451		CAPACITOR-FXD, .01UF+-20% 100WVDC	28480	0160-3451
A6A3C10	0160-2257		CAPACITOR-FXD, 10PF+-5% 500WVDC	28480	0160-2257
A6A3C11	0160-2257		CAPACITOR-FXD, 10PF+-5% 500WVDC	28480	0160-2257
A6A3CR1	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A3CR2	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A3CR3	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A3CR4	1901-0535	7	DIODE, SCHOTTKY, SI, 30V MAX VRM 50MA	28480	1901-0535
A6A3CR5	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A3CR6	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A3CR7	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A3CR8	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A3CR9	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A3CR10	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A3CR11	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A3CR12	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A3CR13	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A3Q1	1854-0092	7	TRANSISTOR, NPN SI	28480	1854-0092
A6A3Q2	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A3Q3	1854-0092		TRANSISTOR, NPN SI	28480	1854-0092
A6A3Q4	1854-0092		TRANSISTOR, NPN SI	28480	1854-0092
A6A3Q5	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A3Q6	1853-0276	2	TRANSISTOR, PNP SI	28480	1853-0276
A6A3Q7	1855-0057	2	TRANSISTOR, JFET N-CHAN D-MODE SI	28480	1855-0057
A6A3Q8	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A6A3Q9	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A6A3R1	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	C83901
A6A3R2	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	C83901
A6A3R3	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	C83901
A6A3R4	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	C83901
A6A3R5	0684-1221		RESISTOR, FXD, 1.2K10% .25W CC TUBULAR	01121	C81221
A6A3R6	0684-1221		RESISTOR, FXD, 1.2K10% .25W CC TUBULAR	01121	C81221
A6A3R7	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	C81031
A6A3R8	0684-2231		RESISTOR, FXD, 22K10% .25W CC TUBULAR	01121	C82231
A6A3R9	0757-0446	7	RESISTOR, FXD, 15K1% .125W F TUBULAR	24546	C4-1/8-T0-1502-F
A6A3R10	0684-1021		RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	C81021
A6A3R11	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	C81011
A6A3R12	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	C81011
A6A3R13	0684-2231		RESISTOR, FXD, 22K10% .25W CC TUBULAR	01121	C82231

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A3R14	0684-1221	4	RESISTOR, FXD, 1.2K10% .25W CC TUBULAR	01121	CB1221
A6A3R15	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A3R16	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A6A3R17	0684-2211		RESISTOR, FXD, 220 OHM10% .25W CC	01121	CB2211
A6A3R18	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A3R19	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A6A3R20	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A3U1	1820-0068		INTEGRATED CIRCUIT, DCTL, TTL TRIPLE 3	01295	SN7410N
A6A3XU1	1200-0768		SOCKET, ELFC, IC 14-CONT DIP SLDR TERM	91506	314-AG5D-3R
A6A4	01701-66514		BOARD ASSY:INTEGRATOR	28480	01701-66514
A6A4C1	0180-0230	4	CAPACITOR-FXD, 1UF+-20% 50VDC TA-SOLID	56289	1500105X0050A2
A6A4C2	0180-0230		CAPACITOR-FXD, 1UF+-20% 50VDC TA-SOLID	56289	1500105X0050A2
A6A4C3	0180-0230		CAPACITOR-FXD, 1UF+-20% 50VDC TA-SOLID	56289	1500105X0050A2
A6A4C4	0180-0230		CAPACITOR-FXD, 1UF+-20% 50VDC TA-SOLID	56289	1500105X0050A2
A6A4C5	0160-3451		CAPACITOR-FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A4C6	0160-3451		CAPACITOR-FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A4C7	0160-3448		CAPACITOR-FXD, .001UF+-10% 1000WVDC	28480	0160-3448
A6A4C8	0160-2264		CAPACITOR-FXD, 20PF+-5% 500WVDC	28480	0160-2264
A6A4C9	0160-3451		CAPACITOR-FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A4C10	0160-2257		CAPACITOR-FXD, 10PF+-5% 500WVDC	28480	0160-2257
A6A4C11	0160-2257	4	CAPACITOR-FXD, 10PF+-5% 500WVDC	28480	0160-2257
A6A4CR1	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A4CR2	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A4CR3	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A4CR4	1901-0535		DIODE, SCHOTTKY, SI,	28480	1901-0535
A6A4CR6	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A4CR7	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A4CR8	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A4CR9	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A4CR10	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A4CR11	1901-0040	4	DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A4CR12	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A4CR13	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A4O1	1854-0092		TRANSISTOR, NPN SI	28480	1854-0092
A6A4O2	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A4O3	1854-0092		TRANSISTOR, NPN SI	28480	1854-0092
A6A4O4	1854-0092		TRANSISTOR, NPN SI	28480	1854-0092
A6A4O5	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A4O6	1853-0276		TRANSISTOR, PNP SI	28480	1853-0276
A6A4O7	1855-0057		TRANSISTOR, JFET N-CHAN D-MODE SI	28480	1855-0057
A6A4O8	1854-0215	4	TRANSISTOR, NPN SI	04713	SPS 3611
A6A4O9	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A6A4R1	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A4R2	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A4R3	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A4R4	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A4R5	0684-1221		RESISTOR, FXD, 1.2K10% .25W CC TUBULAR	01121	CB1221
A6A4R6	0684-1221		RESISTOR, FXD, 1.2K10% .25W CC TUBULAR	01121	CB1221
A6A4R7	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A6A4R8	0684-2231	4	RESISTOR, FXD, 22K10% .25W CC TUBULAR	01121	CB2231
A6A4R9	0757-0446		RESISTOR, FXD, 15K1% .125W F TUBULAR	24546	C4-1/8-T0-1502-F
A6A4R10	0684-1021		RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	CB1021
A6A4R11	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A4R12	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A4R13	0684-2231		RESISTOR, FXD, 22K10% .25W CC TUBULAR	01121	CB2231
A6A4R14	0684-1221		RESISTOR, FXD, 1.2K10% .25W CC TUBULAR	01121	CB1221
A6A4R15	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A4R16	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A6A4R17	0684-2211		RESISTOR, FXD, 220 OHM10% .25W CC	01121	CB2211
A6A4R18	0684-3901	4	RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A4R19	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A6A4R20	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A4U1	1820-0068		INTEGRATED CIRCUIT, DCTL, TTL TRIPLE 3	01295	SN7410N
A6A4XU1	1200-0768		SOCKET, ELFC, IC 14-CONT DIP SLDR TERM	91506	314-AG5D-3R
A6A5	01701-66563	1	SWEEP TIME BOARD ASSY	28480	01701-66563
A6A5C1	0160-3354	1	CAPACITOR-FXD, 10UF+5-15% 100WVDC	28480	0160-3354
A6A5C2	0160-2432		CAPACITOR-FXD, .1UF+-5% 100WVDC	84411	863T10451W2

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A5C3	0160-2218	2	CAPACITOR,FXD, .001UF+-5% 300WVDC	28480	0160-2218
A6A5C4	0160-3451		CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A5C5	0160-3451		CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A5C6	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A6A5C7	0160-3443		CAPACITOR,FXD, .1UF+80-20% 50WVDC	28480	0160-3443
A6A5MP1	0510-1101	4	RETAINER, RING, .33 DIA, NI PLT BE CU	28480	0510-1101
A6A5MP2	1460-1148	4	SPRING:TORSION	00000	0BD
A6A5MP3	01840-22502	4	ROLLER:DETENT	28480	01840-22502
A6A5Q1	1854-0221	2	TRANSISTOR, BIPOL, SI, NPN DUAL	28480	1854-0221
A6A5Q2	1853-0086	2	TRANSISTOR, PNP SI	28480	1853-0086
A6A5Q3	1853-0049		TRANSISTOR, PNP SI	28480	1853-0049
A6A5R1	0757-0156	8	RESISTOR, FXD, 1.5M1% .5W MF TUBULAR	30983	MF7C1/2-T0-1504-F
A6A5R2	0757-0779	5	RESISTOR, FXD, 150K1% .25W F TUBULAR	24546	C5-1/4-T0-1503-F
A6A5R3	0757-0156		RESISTOR, FXD, 1.5M1% .5W MF TUBULAR	30983	MF7C1/2-T0-1504-F
A6A5R4	0757-0779		RESISTOR, FXD, 150K1% .25W F TUBULAR	24546	C5-1/4-T0-1503-F
A6A5R5	0757-0156		RESISTOR, FXD, 1.5M1% .5W MF TUBULAR	30983	MF7C1/2-T0-1504-F
A6A5R6	0698-8131	4	RESISTOR, FXD, 150 OHM.1% .25W F	30983	MF52C1/4-T2-1503-B
A6A5R7	0687-1231	2	RESISTOR, FXD, 12K10% .5W CC TUBULAR	01121	EB1231
A6A5R8	0757-0156		RESISTOR, FXD, 1.5M1% .5W MF TUBULAR	30983	MF7C1/2-T0-1504-F
A6A5R9	0698-8131		RESISTOR, FXD, 150 OHM.1% .25W F	30983	MF52C1/4-T2-1503-B
A6A5R10	0757-0465		RESISTOR, FXD, 100K1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A6A5R11	0757-0460	2	RESISTOR, FXD, 61.9K1% .125W F TUBULAR	24546	C4-1/8-T0-6192-F
A6A5R12	0757-0462	2	RESISTOR, FXD, 75K1% .125W F TUBULAR	24546	C4-1/8-T0-7502-F
A6A5R13	2100-1762	9	RESISTOR, VAR, TRMR, 20KOHM 5% WW	28480	2100-1762
A6A5R14	2100-1762		RESISTOR, VAR, TRMR, 20KOHM 5% WW	28480	2100-1762
A6A5R15	2100-1762		RESISTOR, VAR, TRMR, 20KOHM 5% WW	28480	2100-1762
A6A5R16	2100-1762		RESISTOR, VAR, TRMR, 20KOHM 5% WW	28480	2100-1762
A6A5R17	0684-1541	2	RESISTOR, FXD, 150K10% .25W CC TUBULAR	01121	CB1541
A6A5R18	0684-1041		RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	CB1041
A6A5R19	0757-0779		RESISTOR, FXD, 150K1% .25W F TUBULAR	24546	C5-1/4-T0-1503-F
A6A5R20	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A5S1			ROTARY SWITCH CONSISTING OF A6A5MP1, A6A5MP2, A6A5MP3, A6A5S1MP1 & A6A5S1MP2 AND SWITCH CONTACTS ON ETCHED BOARD A6A5.		
A6A5S1MP1	3130-0355	2	ROTOR ASSY:FEMALE	28480	3130-0355
A6A5S1MP2	3130-0354	2	ROTOR ASSY:MALE	28480	3130-0354
A6A6	01701-66515	1	BOARD ASSY:SWEPT TIME	28480	01701-66515
A6A6C1	0160-3324	1	CAPACITOR,FXD, 1UF+-5% 100WVDC	28480	0160-3324
A6A6C2	0160-3451		CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A6C3	0140-0193	1	CAPACITOR,FXD, 82PF+-5% 300WVDC	72136	DM15E820J0300WV1CR
A6A6C4	0160-3451		CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A6C5	0160-3451		CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A6MP1	0510-1101		RETAINER, RING, .33 DIA, NI PLT BE CU	28480	0510-1101
A6A6MP2	1460-1148		SPRING:TORSION	00000	0BD
A6A6MP3	01840-22502		ROLLER:DETENT	28480	01840-22502
A6A6Q1	1854-0221		TRANSISTOR, BIPOL, SI, NPN DUAL	28480	1854-0221
A6A6Q2	1853-0086		TRANSISTOR, PNP SI	28480	1853-0086
A6A6Q3	1853-0049		TRANSISTOR, PNP SI	28480	1853-0049
A6A6R1	0757-0156		RESISTOR, FXD, 1.5M1% .5W MF TUBULAR	30983	MF7C1/2-T0-1504-F
A6A6R2	0757-0779		RESISTOR, FXD, 150K1% .25W F TUBULAR	24546	C5-1/4-T0-1503-F
A6A6R3	0757-0156		RESISTOR, FXD, 1.5M1% .5W MF TUBULAR	30983	MF7C1/2-T0-1504-F
A6A6R4	0757-0779		RESISTOR, FXD, 150K1% .25W F TUBULAR	24546	C5-1/4-T0-1503-F
A6A6R5	0757-0156		RESISTOR, FXD, 1.5M1% .5W MF TUBULAR	30983	MF7C1/2-T0-1504-F
A6A6R6	0698-8131		RESISTOR, FXD, 150 OHM.1% .25W F	30983	MF52C1/4-T2-1503-B
A6A6R7	0687-1231		RESISTOR, FXD, 12K10% .5W CC TUBULAR	01121	EB1231
A6A6R8	0757-0156		RESISTOR, FXD, 1.5M1% .5W MF TUBULAR	30983	MF7C1/2-T0-1504-F
A6A6R9	0698-8131		RESISTOR, FXD, 150 OHM.1% .25W F	30983	MF52C1/4-T2-1503-B
A6A6R10	0757-0465		RESISTOR, FXD, 100K1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A6A6R11	0757-0460		RESISTOR, FXD, 61.9K1% .125W F TUBULAR	24546	C4-1/8-T0-6192-F
A6A6R12	0757-0462		RESISTOR, FXD, 75K1% .125W F TUBULAR	24546	C4-1/8-T0-7502-F
A6A6R13	2100-1762		RESISTOR, VAR, TRMR, 20KOHM 5% WW	28480	2100-1762
A6A6R14	2100-1762		RESISTOR, VAR, TRMR, 20KOHM 5% WW	28480	2100-1762
A6A6R15	2100-1762		RESISTOR, VAR, TRMR, 20KOHM 5% WW	28480	2100-1762
A6A6R16	2100-1762		RESISTOR, VAR, TRMR, 20KOHM 5% WW	28480	2100-1762
A6A6R17	0684-1541		RESISTOR, FXD, 150K10% .25W CC TUBULAR	01121	CB1541
A6A6R18	0684-1041		RESISTOR, FXD, 100K10% .25W CC TUBULAR	01121	CB1041
A6A6S1			ROTARY SWITCH CONSISTING OF A6A6MP1, A6A6MP2, A6A6MP3, A6A6S1MP1, A6A6S1MP2 & SWITCH CONTACTS ON ETCHED BOARD A6A6.		
A6A6S1MP1	3130-0355		ROTOR ASSY:FEMALE	28480	3130-0355
A6A6S1MP2	3130-0354		ROTOR ASSY:MALE	28480	3130-0354

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A7	01701-66550	1	HOLD-OFF COMPONENT ASSY	28480	01701-66550
A6A7C1	0160-3451		CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A7C2	0180-0230		CAPACITOR-FXD, 1UF+-20% 50VDC TA-SOLID	56289	150D105X0050A2
A6A7C3	0180-0197		CAPACITOR-FXD, 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A6A7C4	0160-3451		CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A7C5	0180-0291		CAPACITOR-FXD, 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A6A7C6	0180-1743	1	CAPACITOR-FXD, .1UF+-10% 35VDC TA-SOLID	56289	150D104X9035A2
A6A7C7	0160-0161	1	CAPACITOR,FXD, .01UF+-10% 200WVDC	56289	292P10392
A6A7C8	0140-0203		CAPACITOR,FXD, 30PF+-5% 500WVDC	72136	DM15E300J0500WVICR
A6A7C9	0140-0203		CAPACITOR,FXD, 30PF+-5% 500WVDC	72136	DM15E300J0500WVICR
A6A7C10	0160-0153		CAPACITOR,FXD, .001UF+-10% 200WVDC	56289	292P10292
A6A7C11	0160-2204		CAPACITOR,FXD, 100PF+-5% 300WVDC	28480	0160-2204
A6A7C12	0180-0374	1	CAPACITOR-FXD, 10UF+-10% 20VDC TA-SOLID	56289	150D106X9020B2
A6A7CR1	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A7CR2	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A7CR3	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A7CR4	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A7CR5	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A7CR6	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A7CR7	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A7MP1	0510-1101		RETAINER, RING, .33 DIA, NI PLT RE CU	28480	0510-1101
A6A7MP2	1460-1148		SPRING:TORSION	00000	08D
A6A7MP3	01840-22502		ROLLER:DETENT	28480	01840-22502
A6A7Q1	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A6A7Q2	1853-0203	2	TRANSISTOR, PNP SI	28480	1853-0203
A6A7Q3	1853-0203		TRANSISTOR, PNP SI	28480	1853-0203
A6A7Q4	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A7Q5	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A7Q6	1854-0092		TRANSISTOR, NPN SI	28480	1854-0092
A6A7Q7	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A7R1	0684-2211		RESISTOR, FXD, 220 OHM10% .25W CC	01121	CB2211
A6A7R2	0684-2211		RESISTOR, FXD, 220 OHM10% .25W CC	01121	CB2211
A6A7R3	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A7R4	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A7R5	0684-2231		RESISTOR, FXD, 22K10% .25W CC TUBULAR	01121	CB2231
A6A7R6	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A7R7	0684-1221		RESISTOR, FXD, 1.2K10% .25W CC TUBULAR	01121	CB1221
A6A7R8	0684-2211		RESISTOR, FXD, 220 OHM10% .25W CC	01121	CB2211
A6A7R9	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A7R10	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A7R11	0684-1831		RESISTOR, FXD, 18K10% .25W CC TUBULAR	01121	CB1831
A6A7R12	0684-2221		RESISTOR, FXD, 2.2K10% .25W CC TUBULAR	01121	CB2221
A6A7R13	0757-0465	1	RESISTOR, FXD, 100K1% .125W F TUBULAR	24546	C4-178-T0-1003-F
A6A7R14	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A7R15	0684-2231		RESISTOR, FXD, 22K10% .25W CC TUBULAR	01121	CB2231
A6A7R16	0684-1021		RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	CB1021
A6A7S1			ROTARY SWITCH CONSISTING OF A6A7MP1, A6A7MP2, A6A7MP3, A6A7SIMP1, A6A7SIMP2 & SWITCH CONTACTS ON ETCHED BOARD A6A7.		
A6A7SIMP1	3130-0352		ROTOR ASSY: FEMALE	28480	3130-0352
A6A7SIMP2	3130-0353		ROTOR ASSY: MALE	28480	3130-0353
A6A7U1	1820-0068		INTEGRATED CIRCUIT, DCTL, TTL TRIPLE 3	01295	SN7410N
A6A7XU1	1200-0768		SOCKET, ELEC, IC 14-CONT DIP SLDR TERM	91506	314-AG5D-3R
A6A8	01701-66565	1	HORIZONTAL MODE ASSY	28480	01701-66565
A6A8C1	0180-0197		CAPACITOR-FXD, 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A6A8C2	0180-0197		CAPACITOR-FXD, 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A6A8C3	0160-2204		CAPACITOR,FXD, 100PF+-5% 300WVDC	28480	0160-2204
A6A8CR1	1901-0535		DIODE, SCHOTTKY, SI,	28480	1901-0535
A6A8CR2	1901-0535		DIODE, SCHOTTKY, SI,	28480	1901-0535
A6A8CR3	1901-0535		DIODE, SCHOTTKY, SI,	28480	1901-0535
A6A8CR4	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A8CR5	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A8CR6	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A8CR7	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A8CR8	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A8CR9	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A8CR10	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A8CR11	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A8MP1	1460-1148		SPRING:TORSION	00000	08D
A6A8MP2	01840-22502		ROLLER:DETENT	28480	01840-22502
A6A8MP3	0510-1101		RETAINER, RING, .33 DIA, NI PLT BE CU	28480	0510-1101
A6A8Q1	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A8Q2	1854-0215	2	TRANSISTOR, NPN SI	04713	SPS 3611
A6A8Q3	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A8R1	0757-0446		RESISTOR, FXD, 15K1% .125W F TUBULAR	24546	C4-1/8-T0-1502-F
A6A8R2	0757-0446		RESISTOR, FXD, 15K1% .125W F TUBULAR	24546	C4-1/8-T0-1502-F
A6A8R3	0757-0431		RESISTOR, FXD, 2.43K1% .125W F TUBULAR	24546	C4-1/8-T0-2431-F
A6A8R4	0684-1011	1	RESISTOR, FXD, 100 OHM10% .25W CC	01121	CB1011
A6A8R5	0684-1011		RESISTOR, FXD, 4.7K10% .5W CC TUBULAR	01121	CB1011
A6A8R6	0687-4721		RESISTOR, FXD, 1K10% .25W CC TUBULAR	01121	EB4721
A6A8R7	0684-1021		RESISTOR, FXD, 56K10% .25W CC TUBULAR	01121	CB1021
A6A8R8	0684-5631		RESISTOR, FXD, 56K10% .25W CC TUBULAR	01121	CB5631
A6A8R9	0684-5631	1	RESISTOR, FXD, 56K10% .25W CC TUBULAR	01121	CB5631
A6A8R10	0757-0431		RESISTOR, FXD, 2.43K1% .125W F TUBULAR	24546	C4-1/8-T0-2431-F
A6A8R11	0757-0288		RESISTOR, FXD, 9.09K1% .125W F TUBULAR	30983	MF4C1/8-T0-9091-F
A6A8R12	0698-3156		RESISTOR, FXD, 14.7K1% .125W F TUBULAR	16299	C4-1/8-T0-1472-F
A6A8R13	0684-1031		RESISTOR, FXD, 10K10% .25W CC TUBULAR	01121	CB1031
A6A8R14	0684-1031	1	RESISTOR, FXD, 10K 10% .25W CC TUBULAR	01121	CB 1031
A6A8S1			ROTARY SWITCH CONSISTING OF A6A8MP1, A6A8MP2, A6A8MP3, A6A8SIMP1, A6A8SIMP2, & SWITCH CONTACTS ON ETCHED BOARD A6A8.	28480	3130-0350
A6A8SIMP1	3130-0350		ROTOR ASSY: FEMALE	28480	01701-61903
A6A8SIMP2	01701-61903		ROTOR ASSY: MALE	01295	SN7410N
A6A8U1	1820-0068		INTEGRATED CIRCUIT, DCTL, TTL TRIPLE 3	91506	314-AG5D-3R
A6A8XU1	1200-0768		SOCKET, ELFC, IC 14-CONT DIP SLDR TERM		
A6A9	01701-66547	1	BOARD ASSY: HORIZONTAL PREAMPLIFIER	50439	01701-66547
A6A9C1	0160-3453	1	CAPACITOR, FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A6A9C2	0160-3453		CAPACITOR, FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A6A9C3	0160-3453		CAPACITOR, FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A6A9C4	0160-3453		CAPACITOR, FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A6A9C5	0160-3453		CAPACITOR, FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A6A9C6	0180-0230	1	CAPACITOR, FXD, .1UF+20% 50VDC TA-SOLID	56289	1500105X0050A2
A6A9C7	0160-3451		CAPACITOR, FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A9C8	0160-3451		CAPACITOR, FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A9C9	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A9CR1	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A9CR2	1901-0040	1	DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A9CR3	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A9CR4	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A9CR5	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A6A9CR6	1901-0535		DIODE, SCHOTTKY, SI,	28480	1901-0535
A6A9CR7	1901-0535	1	DIODE, SCHOTTKY, SI,	28480	1901-0535
A6A9Q1	1854-0019		TRANSISTOR, NPN SI	28480	1854-0019
A6A9Q2	1854-0019		TRANSISTOR, NPN SI	28480	1854-0019
A6A9Q3	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A9Q4	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A9R1	2100-1760	1	RESISTOR, VAR, TRMR, 5KOHM 5% WW	28480	2100-1760
A6A9R2	2100-1762		RESISTOR, VAR, TRMR, 20KOHM 5% WW	28480	2100-1762
A6A9R3	0757-0438		RESISTOR, FXD, 5.1K1% .125W F TUBULAR	24546	C4-1/8-T0-5111-F
A6A9R4	0757-0446		RESISTOR, FXD, 15K1% .125W F TUBULAR	24546	C4-1/8-T0-1502-F
A6A9R5	0757-0441		RESISTOR, FXD, 8.25K1% .125W F TUBULAR	24546	C4-1/8-T0-8251-F
A6A9R6	0757-0465	1	RESISTOR, FXD, 100K1% .125W F TUBULAR	24546	C4-1/8-T0-1003-F
A6A9R7	0757-0472		RESISTOR, FXD, 200K1% .125W F TUBULAR	24546	C4-1/8-T0-2003-F
A6A9R8	0757-0444		RESISTOR, FXD, 12.1K1% .125W F TUBULAR	24546	C4-1/8-T0-1212-F
A6A9R9	0757-0273		RESISTOR, FXD, 3.01K1% .125W F TUBULAR	24546	C4-1/8-T0-3011-F
A6A9R10	0757-0273		RESISTOR, FXD, 3.01K1% .125W F TUBULAR	24546	C4-1/8-T0-3011-F
A6A9R11	0757-0458	3	RESISTOR, FXD, 51.1K1% .125W F TUBULAR	24546	C4-1/8-T0-5112-F
A6A9R12	0757-0283	1	RESISTOR, FXD, 2K1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A6A9R13	0757-0283		RESISTOR, FXD, 2K1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
A6A9R14	0757-0446		RESISTOR, FXD, 15K1% .125W F TUBULAR	24546	C4-1/8-T0-1502-F
A6A9R15	0757-0446		RESISTOR, FXD, 15K1% .125W F TUBULAR	24546	C4-1/8-T0-1502-F
A6A9R16	0757-0273		RESISTOR, FXD, 3.01K1% .125W F TUBULAR	24546	C4-1/8-T0-3011-F
A6A9R17	0757-0753	2	RESISTOR, FXD, 9.09K1% .25W F TUBULAR	24546	C5-1/4-T0-9091-F
A6A9R18			NOT ASSIGNED		
A6A9R19			NOT ASSIGNED		
A6A9R20	0757-0753		RESISTOR, FXD, 9.09K1% .25W F TUBULAR	24546	C5-1/4-T0-9091-F
A6A9R21	2100-1755		RESISTOR, VAR, TRMR, 100 OHM 5% WW	28480	2100-1755
A6A9R22	0684-3901	1	RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A9R23	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A9R24	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A9R25	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CB3901
A6A9R26	0757-0408		RESISTOR, FXD, 243 OHM1% .125W F	24546	C4-1/8-T0-243R-F
A6A9XA1	1251-1604	2	CONNECTOR, PC EDGE, 22-CONT, DIP SOLDER	71785	252-22-30-310
A6A9XA2	1251-1604		CONNECTOR, PC EDGE, 22-CONT, DIP SOLDER	71785	252-22-30-310

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6A10	01701-66557	1	BOARD ASSY:HORIZONTAL OUTPUT	50439	01701-66557
A6A10C1	0160-2235	2	CAPACITOR,FXD, .75PF+- .25PF X 500WVDC	28480	0160-2235
A6A10C2	0160-3453		CAPACITOR,FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A6A10C3	0160-3453		CAPACITOR,FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A6A10C4	0160-2235	2	CAPACITOR,FXD, .75PF+- .25PF X 500WVDC	28480	0160-2235
A6A10C5	0160-3451		CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A10C6	0160-3451		CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A10C7	0160-3451	2	CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A10C8	0160-3451		CAPACITOR,FXD, .01UF+80-20% 100WVDC	28480	0160-3451
A6A10C9	0160-3453	1	CAPACITOR,FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A6A10C10	0160-3453		CAPACITOR,FXD, .05UF+80-20% 100WVDC	28480	0160-3453
A6A10MP1	1205-0095		HEAT-DISSIPATOR, SGL, T0-5 PKG	28480	1205-0095
A6A10C1	1853-0036	1	TRANSISTOR, PNP SI	28480	1853-0036
A6A10C2	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A6A10C3	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A6A10C4	1854-0215	2	TRANSISTOR, NPN SI	04713	SPS 3611
A6A10C5	1854-0271		TRANSISTOR, NPN SI	28480	1854-0271
A6A10C6	1854-0271		TRANSISTOR, NPN SI	28480	1854-0271
A6A10C7	1853-0037	2	TRANSISTOR, PNP SI	28480	1853-0037
A6A10C8	1853-0037	1	TRANSISTOR, PNP SI	28480	1853-0037
A6A10R1	0757-0449		RESISTOR, FXD, 20K1% .125W F TUBULAR	24546	C4-1/8-T0-2002-F
A6A10R2	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	C83901
A6A10R3	0684-3901	1	RESISTOR, FXD, 39 OHM10% .25W CC	01121	C83901
A6A10R4	0757-0449		RESISTOR, FXD, 20K1% .125W F TUBULAR	24546	C4-1/8-T0-2002-F
A6A10R5	0684-1011	1	RESISTOR, FXD, 100 OHM10% .25W CC	01121	C81011
A6A10R6	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	C81011
A6A10R7	0757-0458		RESISTOR, FXD, 51.1K1% .125W F TUBULAR	24546	C4-1/8-T0-5112-F
A6A10R8	0757-0458	1	RESISTOR, FXD, 51.1K1% .125W F TUBULAR	24546	C4-1/8-T0-5112-F
A6A10R9	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	C81011
A6A10R10	0684-1011	1	RESISTOR, FXD, 100 OHM10% .25W CC	01121	C81011
A6A10R11	0684-4721		RESISTOR, FXD, 4.7K10% .25W CC TUBULAR	01121	C84721
A6A10R12	0684-4721		RESISTOR, FXD, 4.7K10% .25W CC TUBULAR	01121	C84721
A6A10R13	0757-0273	1	RESISTOR, FXD, 3.0K1% .125W F TUBULAR	24546	C4-1/8-T0-3011-F
A6A10R14	0757-0273		RESISTOR, FXD, 3.0K1% .125W F TUBULAR	24546	C4-1/8-T0-3011-F
A6A10R15	0757-0416		RESISTOR, FXD, 511 OHM1% .125W F	24546	C4-1/8-T0-511R-F
A6A10R16	0757-0416	1	RESISTOR, FXD, 511 OHM1% .125W F	24546	C4-1/8-T0-511R-F
A6A10VRI	1902-0041		DIODE, VREG, 5.11V VZ, .4W MAX	28480	1902-0041
A7	01701-26520	1	BOARD:SCALE ILLUMINATION	50439	01701-26520
A7DS1	2140-0253	2	LAMP, INCAND, BULB T-1, 28V	71744	CM6839
A7DS2	2140-0253		LAMP, INCAND, BULB T-1, 28V	71744	CM6839
A8	01701-66524	1	EXTERNAL HORIZONTAL AMPLIFIER BD ASSY	28480	01701-66524
A8C1	0121-0454	1	CAPACITOR, VAR, TRMR, AIR, 1.7/11PF	74970	187-0106-105
A8C2	0140-0202		CAPACITOR,FXD, 15PF+-5% 500WVDC	72136	DM15C150J0500WV1CR
A8C3	0180-0197		CAPACITOR-FXD, 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A8C4	0180-0197	1	CAPACITOR-FXD, 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A8CR1	1901-0376		DIODE, GEN PRP, SI, 35V MAX VRM 50MA	28480	1901-0376
A8CR2	1901-0376	1	DIODE, GEN PRP, SI, 35V MAX VRM 50MA	28480	1901-0376
A8CR3	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A8CR4	1901-0040		DIODE, SWITCHING, SI, 30V MAX VRM 50MA	28480	1901-0040
A8Q1	5080-0498	1	Q:FET(MATCHED PAIR)	28480	5080-0498
A8Q2			PART OF A8Q1.	28480	
A8Q3	1854-0215		TRANSISTOR, NPN SI	04713	SPS 3611
A8Q4	1854-0215	1	TRANSISTOR, NPN SI	04713	SPS 3611
A8Q5	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A8Q6	1853-0036		TRANSISTOR, PNP SI	28480	1853-0036
A8Q7	1854-0215	1	TRANSISTOR, NPN SI	04713	SPS 3611
A8R1	0698-6654		RESISTOR, FXD, 800K1% .25W F TUBULAR	30983	MF4C1/8-T0-8003-F
A8R2	0757-0472		RESISTOR, FXD, 200K1% .125W F TUBULAR	24546	C4-1/8-T0-2003-F
A8R3	0684-3901	1	RESISTOR, FXD, 39 OHM10% .25W CC	01121	C83901
A8R4	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	C83901
A8R5	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	C81011
A8R6	0684-1011	1	RESISTOR, FXD, 100 OHM10% .25W CC	01121	C81011
A8R7	0757-0440		RESISTOR, FXD, 7.5K1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A8R8	0757-0414		RESISTOR, FXD, 432 OHM1% .125W F	24546	C4-1/8-T0-432R-F
A8R9	0757-0440	1	RESISTOR, FXD, 7.5K1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
A8R10	0757-0280		RESISTOR, FXD, 1K1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F

See introduction to this section for ordering information

Table 6-2. Replaceable Parts (Cont'd)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
ARR11	0757-0440	1	RESISTOR, FXD, 7.5K1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
ARR12	0757-0283		RESISTOR, FXD, 2K1% .125W F TUBULAR	24546	C4-1/8-T0-2001-F
ARR13	0757-0440		RESISTOR, FXD, 7.5K1% .125W F TUBULAR	24546	C4-1/8-T0-7501-F
ARR14	0757-0280		RESISTOR, FXD, 1K1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
ARR15	2100-2521		RESISTOR, VAR, TRMR, 2KOHM 10% C	19701	ET50X202
ARR16	0757-0435	1	RESISTOR, FXD, 3.92K1% .125W F TUBULAR	24546	C4-1/8-T0-3921-F
ARR17	0757-0280		RESISTOR, FXD, 1K1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
ARR18	0757-0280		RESISTOR, FXD, 1K1% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
ARR19	0684-1011		RESISTOR, FXD, 100 OHM10% .25W CC	01121	CR1011
ARR20	0684-3321		RESISTOR, FXD, 3.3K10% .25W CC TUBULAR	01121	CR3321
ARR21	0684-1011	1	RESISTOR, FXD, 100 OHM10% .25W CC	01121	CR1011
ARR22	0684-3901		RESISTOR, FXD, 39 OHM10% .25W CC	01121	CR3901
ARU1	1821-0002		INTEGRATED CIRCUIT, LIN, TRANSISTOR	02735	CA3045
ARXU1	1200-0768		SOCKET, ELEC, IC 14-CONT DIP SLDR TERM	91506	314-AG5D-3R

Table 6-3. List of Manufacturers' Codes

MFR NC.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00000	NO M/F DESCRIPTION FOR THIS MFG NUMBER	ANY SUPPLIER OF U.S.A.	
00835	U.S.A. COMMON		
01121	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
01295	ALLEN BRADLEY CO.	MILWAUKEE, WIS.	53204
02735	TEXAS INSTRUMENTS INC. SEMICONDUCTOR COMPONENTS DIV.	DALLAS, TEX.	75231
03508	RCA SOLID STATE & RECEIVING TUBE DIV.	SOMERVILLE, N.J.	08876
03877	G.F. CO. SEMICONDUCTOR PROD. DEPT.	SYRACUSE, N.Y.	13201
03888	TRANSITRON ELECTRONIC CORP.	WAKEFIELD, MASS.	01880
04713	PYROFILM CORP.	WHIPPANY, N.J.	07981
07263	MOTOROLA SEMICONDUCTOR PROD. INC.	PHOENIX, ARIZ.	85008
08806	FAIRCHILD CAMERA & INST. CORP. SEMICONDUCTOR DIV.	MOUNTAIN VIEW, CALIF.	94040
09353	G.F. CO. MINIATURE LAMP DEPT.	CLEVELAND, OHIO	44112
12697	C & K COMPONENTS INC.	NEWTON, MASS.	02158
16037	CLAROSTAT MFG. CO. INC.	DOVER, N.H.	03820
16299	SPRUCE PINE MICA CO.	DOVER, N.H.	28777
19701	CORNING GLASS WORKS ELECTRONIC COMPONENTS DIVISION	SPRUCE PINE, N.C.	27604
24226	ELECTRA/MIDLAND CORP.	RALEIGH NC	76067
24546	GOWANDA ELECTRONICS CORP	MINERAL WELLS, TEX.	14070
24618	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
26742	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
27264	METHODE ELECTRONICS INC.	CHICAGO IL	60656
28480	MOLEX PROD. CO.	DOWNERS GROVE, ILL.	60515
30983	HEWLETT-PACKARD CO. CORPORATE HQ	YOUR NEAREST HP OFFICE	
50439	ELECTRA/MIDLAND CORP POTENTIOMETER DIVISION	SAN DIEGO CA	92121
56289	HEWLETT-PACKARD CO. COLORADO SPRINGS DIV.	COLORADO SPRINGS, COLO	80907
57771	SPRAGUE ELECTRIC CO.	N. ADAMS, MASS.	01247
70903	STIMPSON EDWIN B CO INC	BAYPORT NY	11705
71400	BELEN CORP.	CHICAGO, ILL.	60644
71744	BUSSMANN MFG. DIV. MC GRAW-EDISON CO.	ST. LOUIS, MO.	63017
71785	CHICAGO MINIATURE LAMP WORKS	CHICAGO, ILL.	60640
72136	CINCH MFG. CO. DIV TRW INC.	ELK GROVE VILLAGE, ILL.	
72765	ELECTRO MOTIVE MFG. CO. INC.	WILLIMANTIC, CONN.	06226
72982	DRAKE MFG. CO.	HARWOOD HEIGHTS, ILL.	60656
74570	ERIE TECHNOLOGICAL PROD. INC.	ERIE, PA.	16512
75042	JOHNSON E.F. CO.	WASECA, MINN.	56093
75915	INTERNATIONAL RESISTANCE CO. INC.	PHILADELPHIA, PA.	19108
77250	LITTELFUSE INC.	DES PLAINES, ILL.	60016
77764	PHENIX MFG. CO. DIV. ALLIED PROD. CORP.	CHICAGO, ILL.	60650
77969	RESISTANCE PROD. CO.	HARRISBURG, PA.	17104
78189	RUBERCRAFT CORP. OF CALIF. LTD.	TORRANCE, CALIF.	90507
78553	SHAKFPROOF DIV. ILLINOIS TOOL WORKS	ELGIN, ILL.	60120
79136	TINNEMAN PROD. INC.	CLEVELAND, OHIO	44129
80131	WALDES KOHINOOR INC.	LONG IS. CITY, N.Y.	11101
81812	ELECTRONIC INDUSTRIES ASSOCIATION	YOUR NEAREST E.I.A. DEALER	
84411	TRIMM INC	LIBERTYVILLE IL	60048
91500	TRW CAPACITOR DIV.	OGALLALA, NEBR.	69153
91506	ASHENVILLE-SCHOONMAKER MICA CO	NEWPORT NEWS VA	23607
91637	AUGAT INC.	ATTLEBORO, MASS.	02703
94222	DALE ELECTRONICS INC.	COLUMBUS, NEB.	68601
95712	SOUTHCO INC.	LESTER, PA.	19113
95987	BENDIX CORP. THE MICROWAVE DEVICE DIV.	FRANKLIN, IND.	46131
97464	WECKESSER CO. INC.	CHICAGO, ILL.	60641
98159	INDUSTRIAL RETAINING RING CO.	IRVINGTON, N.J.	07111
99800	RUBBER TECK INC.	GARDENA, CALIF.	90247
	DELEVAN ELECTRONICS CORP.	E. AURORA, N.Y.	14052

SECTION VII

MANUAL CHANGES AND OPTIONS

7-1. INTRODUCTION.

7-2. This section contains information required to backdate or update this manual for a specific instrument. Descriptions of special options and standard options are also in this section.

7-3. MANUAL CHANGES.

7-4. This manual applies directly to the instrument having the same serial prefix shown on the manual title page. If the serial prefix of the instrument is not the same as the one on the title page, or covered by an enclosed Manual Change Sheet, order a copy of Supplement B to instrument manual (HP Part No. 01707-90916). Supplement B carries information for backdating this manual to cover older instruments. If a Manual Change Sheet is supplied make all indicated errata corrections.

7-5. SPECIAL OPTIONS.

7-6. Most customer special application requirements and/or specifications can be met by factory modification of a standard instrument. A standard instrument modified in this way will carry a special option number, such as Model 0000A/Option C01.

7-7. An operating and service manual and a manual insert are provided with each special option instrument. The operating and service manual contains information about the standard instrument. The manual insert for the special option describes the factory modifications required to produce the special option instrument. Amend the operating and service manual by changing it to include all manual insert information (and manual change pages, if applicable). When these changes are made, the operating and service manual will apply to the special option instrument.

7-8. If you have ordered a special option instrument and the manual insert is missing, notify the nearest Hewlett-Packard Sales/Service Office. Be sure to give a full description of the instrument, including the complete serial number and special option number.

7-9. STANDARD OPTIONS.

7-10. Standard options are modifications installed on HP instruments at the factory and are available on request. Table 7-1 lists the Model 1707B standard options.

Table 7-1. Model 1707B Standard Options

Option	Description	HP Part No.
002	Replace standard P31 phosphor CRT (V1) with internal graticule P2 phosphor CRT.	5083-2722
007	Replace standard P31 phosphor CRT (V1) with internal graticule P7 phosphor CRT.	5083-2732
011	Replace standard P31 phosphor CRT (V1) with internal graticule P11 phosphor CRT.	5083-2742
012	Standard instrument with Model 10103B Battery Pack.	Model 10103B Battery Pack
015	Standard instrument with channel A output.	
602	Replace standard P31 phosphor CRT (V1) with no graticule P2 phosphor CRT.	5083-2721
607	Replace standard P31 phosphor CRT (V1) with no graticule P7 phosphor CRT.	5083-2731
611	Replace standard P31 phosphor CRT (V1) with no graticule P11 phosphor CRT.	5083-2741
631	Replace standard P31 phosphor CRT (V1) with no graticule P31 phosphor CRT.	5083-2751

SECTION VIII

SCHEMATICS AND TROUBLESHOOTING

8-1. INTRODUCTION.

8-2. This section contains schematics, repair and replacement information, component-identification illustrations, waveforms, and test conditions. Table 8-3 defines symbols and conventions used on the schematics. A disassembly procedure for removing the CRT and instrument modules for repair and replacement is also contained in this section.

8-3. SCHEMATICS.

8-4. Schematics are printed on foldout pages for easy reference to the text and figures in other sections. The schematics are drawn to show the electronic function of the circuits. Any one schematic may include all or part of several different physical assemblies. Non MIL-standard symbols and conventions used in the schematics are defined in table 8-3.

8-5. The schematics are numbered in sequence with a bold number at the lower right-hand corner of each page. These numbers are used to cross reference signal connections between the schematics. At each circuit breaking point, a number in a circle is shown, followed by another number in bold type. The circled number indicates the signal or circuit and the bold number indicates the associated schematic that contains the source or destination of the signal. To find the source or destination of the signal, turn to the indicated schematic and find the circled number in question.

8-6. A table on each schematic lists all components shown on the schematic by reference designation. Component reference designators that have been deleted from the schematic are listed below the table.

8-7. The physical locations of components on etched circuit boards and assemblies are identified by dashed lines. Refer to illustrations 1, 2, and 3 on table 8-3.

8-8. REFERENCE DESIGNATIONS.

8-9. The unit system of reference designations used in this manual is in accordance with the provisions of USA Standard Y32.16-1968, Reference Designations for Electrical and Electronics Parts and Equipments, dated March 1, 1968. Minor variations from the standard, due to design and manufacturing practices, may be noted.

8-10. Each electrical component is assigned a class letter and a number. This letter-number combination is the basic reference designation. Components which are part of an assembly have, in addition to the basic designation, a prefix designation indicating the assembly of which the component is a part. For instance, resistor R23 on assembly A1 is called A1R23.

8-11. Assemblies are numbered consecutively. If an assembly reference designation is assigned and later deleted, that number is not reused.

8-12. COMPONENT LOCATIONS.

8-13. Locations of components on assemblies and subassemblies are illustrated on photographs adjacent to the schematics. Since the schematics are drawn to show function, portions of a particular assembly may appear on several different schematics. The component-location photograph is printed next to the schematic that shows most of the circuitry on the assembly. In some cases, a particular component-location photograph may appear adjacent to more than one schematic.

8-14. Components located on the chassis are identified in figures 8-4 and 8-5. The locations of all adjustments are shown in Section V.

8-15. PREVENTIVE MAINTENANCE.

8-16. Preventive maintenance consists of periodic performance checks, calibration, mechanical inspection, lubrication, and other services designed to prevent breakdown and failure. Performance checks and calibration are covered in Section V of this manual. The other preventive maintenance services are covered in the following paragraphs.

8-17. MECHANICAL INSPECTION.

8-18. Periodically inspect the instrument for damaged components, excess grease, dirt, and corrosion. Look for loose and misaligned assemblies. Ensure that all screws and fasteners are tight and serviceable.

8-19. Refer to the paragraphs in this section on repair and replacement for instructions on replacing damaged components.

8-20. Painted surfaces can be cleaned with a commercial, spray-type, window cleaner or with a mild soap and water solution. Excess grease can be re-

moved with a degreaser such as MS-180 FREON TF DEGREASER produced by Miller-Stevenson Chemical Company.

8-21. Corroded spots are best removed with soap and water. Stubborn residues can be removed with a fine abrasive. When using abrasives, be careful that fine particules do not fall into the instrument. Cleaned areas should be protected from further corrosion by an application of a silicon resin such as GE DRI-FILM 88.

8-22. SWITCH MAINTENANCE.

8-23. The pushbutton switches used in this instrument have been designed for long, trouble-free service. In the event that one of these switches becomes defective, replacement rather than repair is recommended.

8-24. The rotary switches in this instrument can easily be serviced after removal of the assembly on which the switch is mounted. In the case of the TIME/DIV switch, the TIME/DIV switch shaft must be removed. Refer to the paragraphs on repair and replacement in this section for instructions on disassembly of the modules in the instrument.

8-25. Conventional rotary switches are serviced by cleaning the contacts with a degreaser such as MS-180 FREON TF DEGREASER. The contact surfaces are then lubricated with a lubricant comparable to LUBRIPLATE FML produced by the Fiske Brothers Refining Company. LUBRIPLATE FML is available from the Hewlett-Packard Company. Order HP Part No. 6040-0305.

8-26. The switches on the main sweep time assembly, delayed sweep time assembly, horizontal mode assembly, and holdoff and comparator assembly can be serviced as follows:

- a. Remove TIME/DIV knob and shaft (paragraph 8-39).
- b. Remove printed circuit board keeper from top of assemblies.
- c. Remove assembly or assemblies to be serviced. See figure 8-5 for assembly locations.
- d. Note orientation of open part of rotor section.

NOTE

The following steps use the main sweep time assembly (figure 8-24) as an example.

- e. Remove retainer ring MP1.

- f. Separate two rotor sections, S1MP1 and S1MP2, from etched circuit board.

- g. Check contact area of etched circuit board. If contact area shows excessive wear, replace etched circuit board.

- h. Check contacts on two rotor sections. If contacts show excessive wear, replace rotor.

- i. Clean and lubricate contacts on etched circuit board and rotors as described in paragraph 8-25.

- j. Place rotor sections on etched circuit board and reinstall retainer ring MP1.

- k. Position open part of rotor section as noted in step d.

- l. Reinstall TIME/DIV shaft and knob assembly.

8-27. REPAIR AND REPLACEMENT.

8-28. The following paragraphs provide procedures for removal and replacement of assemblies, sub-assemblies, and components. Special servicing instructions for the etched circuit boards are provided in paragraph 8-54. Section VI provides a detailed parts list for use in ordering replacement parts. Refer to table 8-2 for the location of a particular assembly.

8-29. CRT REMOVAL AND REPLACEMENT.

WARNING

To prevent personal injury, wear a face mask or goggles when handling the CRT. Wear protective gloves and handle the CRT carefully.

8-30. To remove and replace the CRT, see figure 6-2 and proceed as follows:

- a. Remove top and bottom covers from instrument.
- b. Remove rear panel CRT socket cover (MP57).
- c. Remove front panel CRT bezel by squeezing at midpoint on bottom and rotating outward and upward.
- d. Remove filter if in use.
- e. Remove two screws holding vertical amplifier shield (MP60) and tilt to side of instrument.
- f. Remove five wires from neck of CRT.
- g. Remove two scale illumination wires from front of CRT.

WARNING

Failure to discharge high voltage can result in severe electrical shock and damage to instrument.

h. Unplug post-accelerator connector, and immediately discharge lead to ground.

i. Remove CRT shock mounting screws on rear panel.

j. Remove two screws from rear of CRT shield (MP75).

k. Loosen CRT clamp.

l. Carefully remove CRT socket (MP84).

m. Rotate shield and shock mount (MP74) 45 degrees until shock mount flanges are in corners of square access opening of rear panel.

n. Pull shield (MP75) back.

o. Place one hand on CRT face and use other hand to slide CRT toward rear of instrument until CRT can be raised upward and out of instrument.

p. To reinstall CRT, reverse removal procedure.

8-31. VERTICAL AMPLIFIER MODULE REMOVAL AND REPLACEMENT.

8-32. To remove the vertical amplifier module, proceed as follows:

a. Using allen wrench, loosen allen screws in POSITION, VOLTS/DIV, and DISPLAY control knobs.

b. Remove control knobs.

c. Pull plastic covers from coupling switches.

d. Remove top and bottom covers from instrument.

e. Disconnect main harness wires from vertical preamplifier assembly.

f. Disconnect two wires from delay line to vertical output amplifier.

g. Remove two screws holding vertical output amplifier to vertical amplifier module.

h. Remove vertical output amplifier assembly.

i. Hold vertical preamplifier assembly.

j. Remove nuts on VOLTS/DIV and POSITION controls.

k. Gently lift vertical module assembly out.

l. To reinstall vertical amplifier module, reverse removal procedure.

8-33. DELAY LINE REMOVAL AND REPLACEMENT.

8-34. To remove the delay line from the vertical amplifier module, proceed as follows:

a. Remove vertical amplifier module as described in paragraph 8-31.

b. Unsolder two wires (red, blue) from end of delay line to vertical preamplifier assembly. Mark locations of wires to facilitate correct reassembly.

c. Remove two center screws from bottom side of vertical module (C, figure 8-1).

d. Rotate delay line slightly and remove.

NOTE

The two wires to the vertical output amplifier assembly go through a rubber grommet. These two wires must be carefully brought through the grommet during removal of the delay line.

e. To reinstall delay line, reverse removal procedure.

8-35. ATTENUATOR REMOVAL AND REPLACEMENT.

8-36. To remove the attenuator assemblies from the vertical amplifier module, proceed as follows:

a. Remove vertical amplifier module as described in paragraph 8-31.

b. Remove locking nuts (A, figure 8-1).

c. Remove six screws on bottom side of vertical amplifier module (B and C, figure 8-1).

d. Remove delay line as described in paragraph 8-33.

e. Unsolder C1 from BNC input connectors (figure 8-2).

f. Remove nuts holding BNC connectors to shield.

g. Remove BNC connectors.

h. Slide vertical preamplifier back from shield.

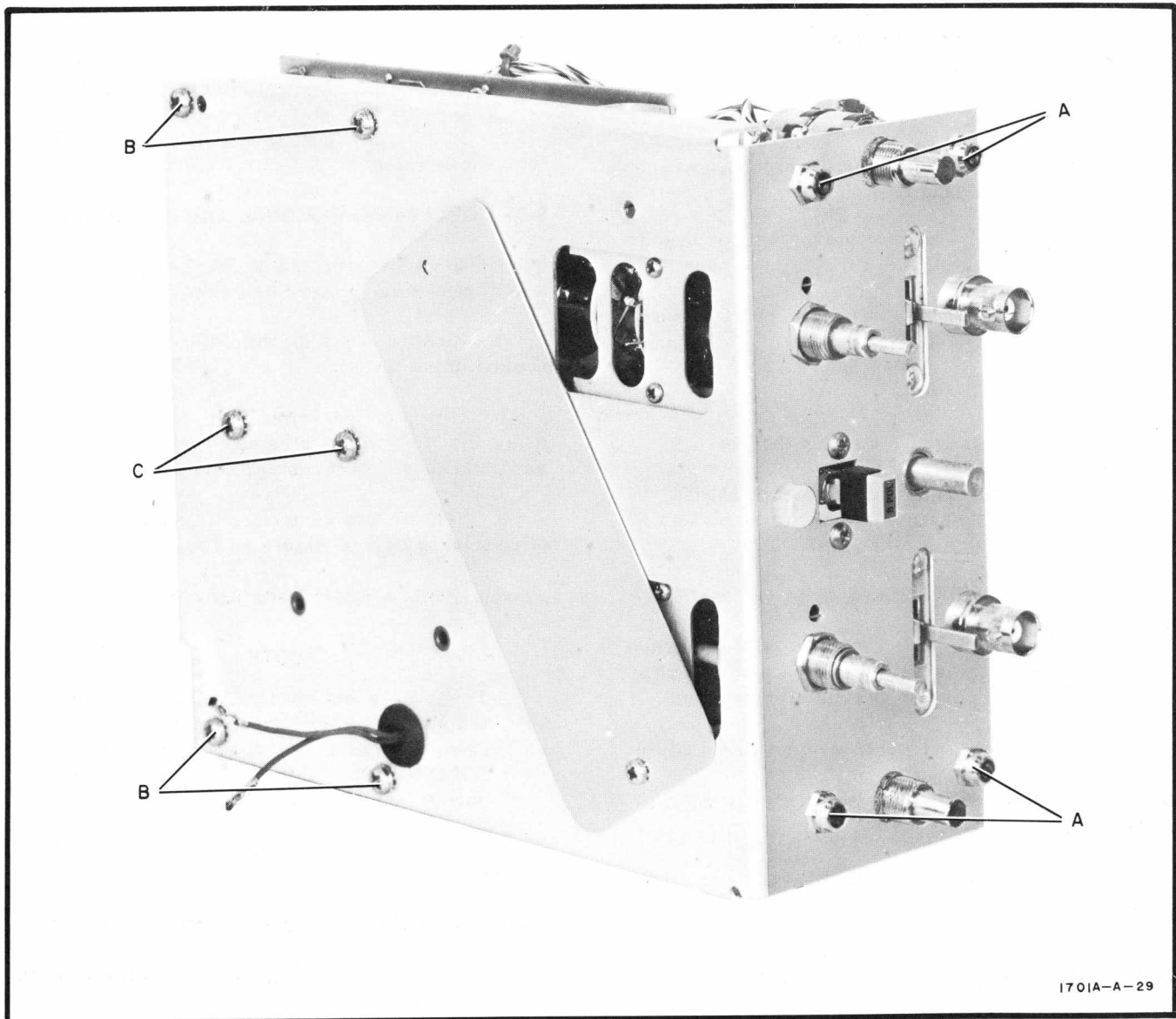


Figure 8-1. Vertical Module Mechanical Parts Removal

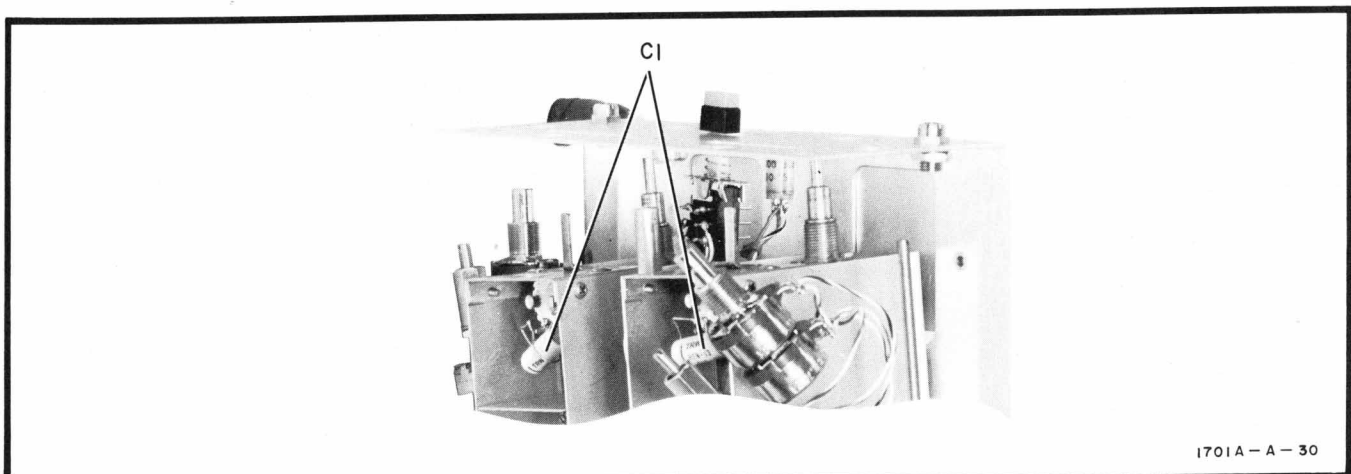


Figure 8-2. Attenuator Removal

i. Raise vertical preamplifier up and unsolder components connected between attenuators and vertical preamplifier board.

j. Remove two screws for each attenuator from top side of preamplifier board.

k. Lift attenuators from board.

l. To reinstall attenuators, reverse removal procedure.

8-37. REMOVAL AND REPLACEMENT OF ASSEMBLIES IN HORIZONTAL AMPLIFIER MODULE.

8-38. The following paragraphs provide information required to remove and replace the various assemblies in the horizontal amplifier module.

8-39. *TIME/DIV Switch Removal and Replacement.* To remove the TIME/DIV switch, proceed as follows:

a. Set TIME/DIV controls as follows:

sweep display	DELAYED SWEEP
main TIME/DIV	.2 SEC
delayed TIME/DIV	10 uSEC

b. Loosen locking collar setscrew on inside front panel of instrument.

c. Pull TIME/DIV shaft out.

d. To reinstall TIME/DIV shaft, reverse removal procedure.

8-40. *Plug-in Assemblies Removal and Replacement.* After removal of the TIME/DIV shaft, the five plug-in assemblies in the horizontal amplifier module can be removed as follows:

a. Remove etched circuit board keeper from top of assemblies.

b. Gently rock assemblies from side to side while pulling upward to remove from sockets.

c. To reinstall assemblies, reverse removal procedure.

8-41. *Trigger Assembly and Horizontal Mother Board Removal and Replacement.* To remove the trigger assembly and horizontal mother board, proceed as follows:

a. Remove TIME/DIV shaft as described in paragraph 8-39.

b. Remove five assemblies as described in paragraph 8-40.

c. Disconnect wires (top and bottom) to horizontal preamplifier board.

d. Remove two screws from horizontal preamplifier board.

e. Disconnect wires to trigger assembly.

f. Separate horizontal amplifier from trigger assembly and horizontal mother board.

g. Remove horizontal preamplifier board.

h. Hold trigger assembly and remove four screws that hold assembly.

i. Carefully remove trigger assembly.

j. Horizontal mother board can be removed by disconnecting wires connected to it.

k. To reinstall, reverse removal procedure.

8-42. POWER SUPPLY MODULE REMOVAL AND REPLACEMENT.

8-43. To remove power supply module from instrument, proceed as follows:

a. Turn instrument off and remove power cord.

b. Remove top and bottom covers.

c. Unplug CRT post-accelerator lead.

NOTE

Do not attempt to remove lead from CRT glass.

d. Turn instrument on its side.

e. Remove battery if instrument is Option 012.

f. Unplug P1 connector (power supply to main cable).

g. Using #1 Pozidrive screwdriver, remove two flathead screws directly in front of power transformer T1.

h. To reinstall power supply module, reverse removal procedure.

8-44. POWER SUPPLY MODULE DISASSEMBLY AND REASSEMBLY.

8-45. To disassemble power supply module, proceed as follows:

a. Remove power box cover.

b. Using board puller furnished with service kit, hook on inside of standoffs between two low voltage boards and pull straight out.

c. Disconnect A3Q2 from low voltage mother board.

d. Disconnect both ends of wires from low voltage mother board to high voltage oscillator.

e. Remove four screws holding low voltage mother board.

f. Carefully compress sides of J1 to release it from power box.

g. Lift low voltage mother board from power box.

WARNING

Failure to discharge high voltage can result in severe electrical shock.

h. Discharge (to ground) high voltage points where high voltage wires are connected.

i. Disconnect wires from high voltage transistor.

j. Pull high voltage oscillator from power box.

k. To reinstall, reverse removal procedure.

8-46. SEMICONDUCTOR REMOVAL AND REPLACEMENT.

8-47. Figure 8-3 is included to help identify the leads on the common shapes and sizes of semiconductor devices. When removing a semiconductor, use long-nosed pliers as a heat sink between the device and the soldering iron. When replacing a semiconductor, ensure sufficient lead length to dissipate the soldering heat by using the same length of exposed lead as used for the original part.

8-48. ATTENUATOR SERVICING.

8-49. A metal plate provides access to the attenuators. The plate is located under the front of the CRT. Service for the attenuators is accomplished by removing the CRT (paragraph 8-29) and metal plate. After the attenuators have been serviced, replace the metal plate and CRT.

8-50. CIRCUIT BOARDS.

8-51. The following paragraphs provide information regarding servicing procedures for etched circuit boards, use of heat sinks, and special soldering considerations.

8-52. BOARD CONNECTIONS.

8-53. Square-pin connectors are identified on circuit boards by the color code of the connecting wire. Connector pins on plugs and jacks are identified by either a numeral or a letter. The letters G, I, O, and Q have been omitted. Table 8-3 shows the types of board connections used in the instrument.

8-54. SERVICING ETCHED CIRCUIT BOARDS.

8-55. This instrument uses etched circuit boards with plated-through component holes. This allows components to be removed or replaced by unsoldering or soldering from either side of the board. When removing large components, such as potentiometers, rotate the soldering iron tip from lead to lead while applying pressure to the part to lift it from the board. HP Service Note M-20E contains additional information on repair of etched circuit boards.

8-56. INTEGRATED CIRCUIT REPLACEMENT.

CAUTION

Unless an integrated circuit has definitely failed, be careful to prevent damage when removing or replacing it.

8-57. The integrated circuits in this instrument are of two general configurations, plug-in types and those soldered in place. Remove a plug-in integrated circuit with a straight pull away from the board. Soldered integrated circuits can be removed with soldering irons which simultaneously heat all connections. These irons are available from various manufacturers. Soldering irons with built-in desoldering tools also facilitate quick removal.

8-58. Use the following procedure for removing an integrated circuit with a standard soldering iron.

a. Heat lead solder joint. Use small tip such as on Weller No. PT-H7 iron.

b. When solder is fluid, remove with desoldering tool such as deluxe Model Soldapull manufactured by Edsyn Company of California.

c. Repeat steps a and b for each lead until all leads are free.

d. Grasp each lead with long-nosed pliers and check that it is mechanically free from circuit board.

e. When all leads are free, carefully remove integrated circuit. Dual in-line type can be removed by gently gripping top and bottom with long-nosed pliers and rolling integrated circuit out.

f. Use desoldering tool or toothpick to remove all remaining solder from circuit board holes.

CAUTION

Be careful not to damage the integrated circuit with excessive heat. Work quickly.

g. Insert replacement integrated circuit into circuit board and solder in place.

8-59. When replacing an integrated circuit, note the mark or notch used for orientation. The component-identification photographs and the integrated circuit pin-location diagrams in this manual show the correct orientation.

8-60. SERVICE KIT.

8-61. The service kit (refer to Section I) consists of three extender boards and a board puller. The extenders can be used with the plug-in etched circuit boards. They permit a circuit board to remain connected to the instrument, yet raised to a convenient level for circuit checks and adjustments. The board puller is used to remove the low voltage converter assembly A3A2 and the low voltage rectifier and filter assembly A3A3. Connect the hook portion of the board puller around the metal standoffs that connect the two assemblies and pull the assemblies out.

8-62. SOLDERING TOOLS, SOLDER, AND AIDS.

8-63. Table 8-1 contains a list of soldering tools, solder, and soldering aids. These items or equivalents

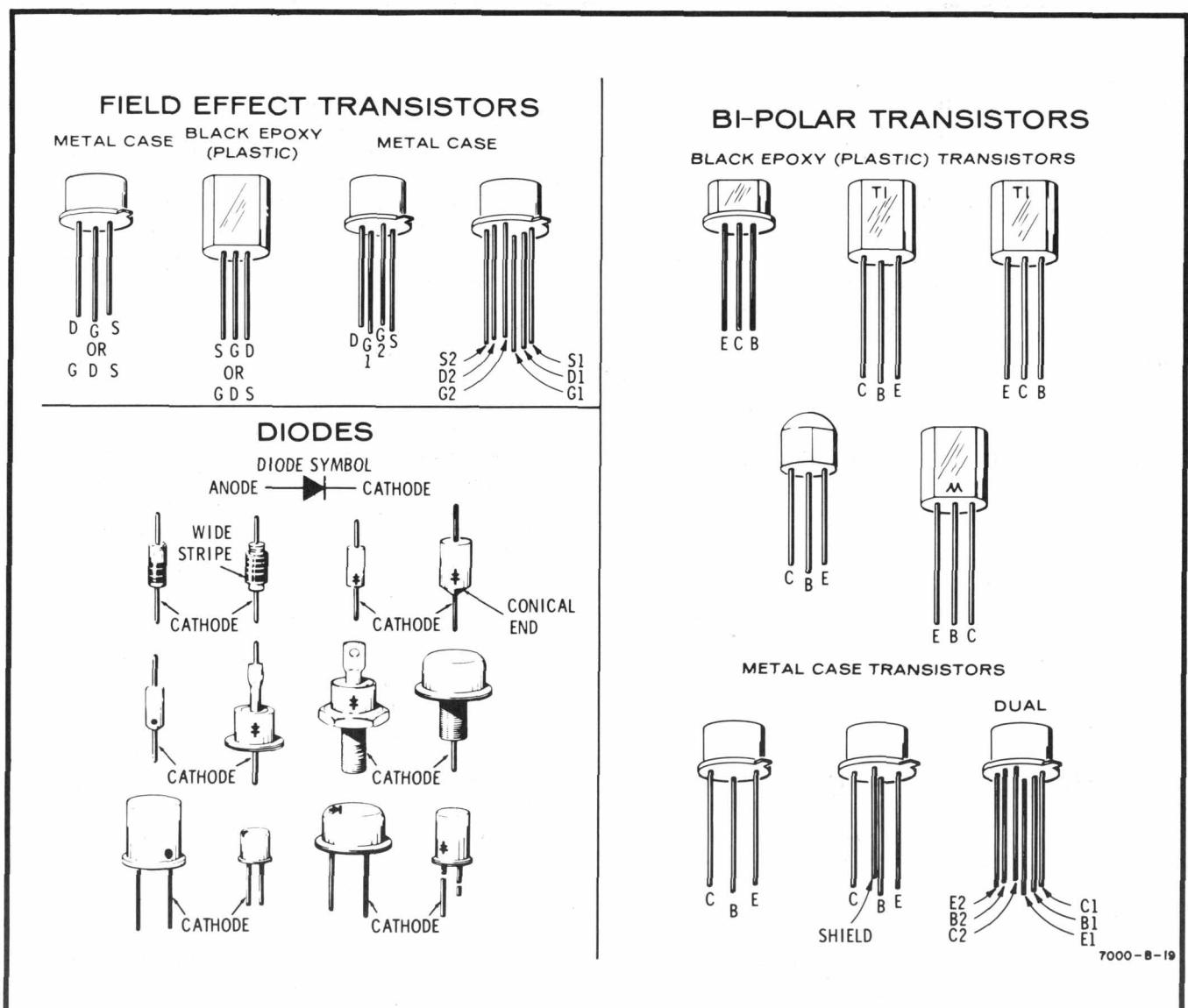


Figure 8-3. Semiconductor Terminal Identification

Table 8-1. Etched Circuit Soldering Equipment

Item	Use	Specification	Item Recommended
Soldering tool	Soldering Unsoldering	Wattage rating: 37 to 50 Tip Temp: 750-800 degrees	Ungar #775 handle with Ungar #1237 Heating Unit
Soldering Tip	Soldering	Shape: chisel	Ungar #PL 113
Desoldering tool	To remove molten solder from connection	Suction device	Soldapullt by Edsyn Co., Arleta, California
Resin (flux) Solvent	Remove excess flux from soldered area before application of protective coating	Must not dissolve etched circuit base board material or conductor bonding agent	Freon Acetone Lacquer Thinner Isopropyl Alcohol (100% dry)
Solder	Component replacement Circuit board repair Wiring	Resin (flux) core, high tin content (60/40 tin/lead). 18 gauge (SWG) preferred	
Protective Coating	Contamination, Corrosion protection	Good electrical insulation, corrosion-prevention properties	Silicone Resin such as GE DRI-FILM *88

should be used to obtain the very best results when repairing and replacing soldered-in components on etched circuit boards.

8-64. HEAT SINK REMOVAL.

8-65. There are two types of transistor heat sinks used in this instrument; the friction type and the screw-on type. The friction type can be removed by carefully pulling them off. To remove the screw-on type, proceed as follows:

- a. Remove transistor from circuit board.
- b. Grasp cooling fins with taped pliers.
- c. Remove nut with 1/2-inch wrench.

CAUTION

When replacing heat sinks, especially friction type, support the bottom of the transistors to avoid lead damage caused by downward pressure.

8-66. TROUBLESHOOTING.

8-67. The most important prerequisite for successful troubleshooting is understanding how the instrument is designed to operate and correct use of front panel controls. Improper control settings or circuit connections can cause apparent malfunctions. Read Section III (Operation) for an explanation of controls and connectors and general operating considerations. Read Section IV (Principles of Operation) for explanations of circuit theory.

8-68. If trouble is suspected, visually inspect the instrument. Look for loose or burned components that might suggest a source of trouble. Check to see that all circuit board connections are making good contact and are not shorting to an adjacent circuit. If no obvious trouble is found, check the power supply voltages in the instrument. Prior to any extensive troubleshooting, also check the external power sources.

8-69. DC VOLTAGES.

8-70. On some of the schematics, dc voltages are indicated for active components (transistors, etc.). Conditions for making these voltage measurements are listed adjacent to the schematics. Since the conditions for making the measurements may differ from one circuit to another, always check the specific condition listed adjacent to the schematic.

8-71. WAVEFORMS.

8-72. Waveform measurement points (illustration 11 on table 8-3) are placed on the schematics along main signal paths. The numbers inside the measurement point symbols are keyed to waveforms and waveform measurement conditions adjacent to the schematics. Like the dc voltage measurement conditions, waveform measurement conditions vary from one circuit to another.

8-73. TEST POINTS.

8-74. Test points (illustration 20 on table 8-3) correspond to pins protruding from etched circuit boards and do not necessarily correspond to waveform measurement points.

Table 8-2. Model 1707B Assembly Locations

Assembly	Description	Schematic Number	Photo Figure No.
A1	Power Module	19	8-4
A2	Line Rectifier	19	8-4, 8-5, 8-42
A3	Power Supply Assembly	18, 19, 20, 21	8-5
A3A1	Low Voltage Mother Board	19, 20, 21	8-5, 8-43
A3A2	Low Voltage Converter	20	8-5, 8-45
A3A3	Line Rectifier and Filter	21	8-5, 8-47
A3A4	High Voltage Oscillator	18	8-5, 8-40
A4	Gate	17, 18, 19, 21	8-5, 8-38
A5	Vertical Amplifier Module	3, 4, 5, 6, 7	8-5, 8-6
A5A1	Attenuator (channel A)	3	8-5, 8-10
A5A2	Attenuator (channel B)	3	8-5, 8-10
A5A3	Delay Line	6	8-5
A5A4	Vertical Preamplifier	4, 5, 6, 7	8-5, 8-12
A5A5	Vertical Output Amplifier	6	8-5, 8-15
A6	Horizontal Amplifier Module	8, 9, 10, 11, 12, 13, 14, 15, 16	8-5, 8-7
A6A1	Horizontal Mother Board	10, 11, 12, 13, 14, 15, 16	8-5, 8-21
A6A2	Trigger	8, 9	8-5, 8-18
A6A3	Main Integrator	10	8-5, 8-22
A6A4	Delayed Integrator	12	8-5, 8-26
A6A5	Main Sweep Time	11	8-5, 8-24
A6A6	Delayed Sweep Time	13	8-5, 8-28
A6A7	Holdoff and Comparator	14	8-5, 8-30
A6A8	Horizontal Mode	15	8-5, 8-32
A6A9	Horizontal Preamplifier	16	8-5, 8-35
A6A10	Horizontal Output Amplifier	16	8-5, 8-36
A7	Scale Illumination Assembly	19	8-5
A8	Ext Horizontal	15	8-5, 8-33

8-75. CIRCUIT CHECKING.

8-76. The block diagram (schematics 1 and 2) have been provided to enable rapid isolation of a malfunction to a particular circuit group. This is accomplished by observing the indicated waveforms and voltages shown on the block diagrams until a block is found whose inputs are normal, but whose outputs are abnormal. Once this point is reached, the input and output to the block is located on the appropriate schematic and progressive troubleshooting techniques (waveform analysis, voltage measurement, resistance

measurement, and substitution) are employed between the two points to isolate the malfunction to a particular component(s).

8-77. Tables 8-4 through 8-8 contain programmed troubleshooting procedures. The tables can be used to completely check the instrument. Start at table 8-4 and follow instructions. Normal indications for a particular section lead to checks of the other sections. Abnormal indications lead to trouble isolation procedures. If trouble is known to exist in a particular section, go directly to the appropriate table, skipping previous tables.

Refer to MIL-STD-15-1A for schematic symbols not listed in this table.

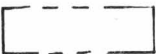
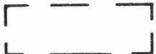
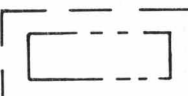
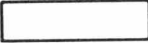
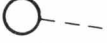
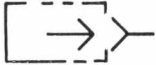
1.		= Etched circuit board	17.		= Main signal path
2.		= Assembly	18.		= Primary feedback path
3.		= Etched circuit board on assembly	19.		= Secondary feedback path
4.		= Front-panel marking	20.		= Test point
5.		= Rear-panel marking	21.		= Field-effect transistor (N-type base)
6.		= Front-panel control	22.		= Breakdown diode (voltage regulator)
7.		= Screwdriver adjustment	23.		= Tunnel diode
8.	P/O	= Part of	24.		= Step-recovery diode
9.	CW	= Clockwise end of variable resistor	25.		= Circuits or components drawn with dashed lines (phantom) show function only and are not intended to be complete. The circuit or component is shown in detail on another schematic.
10.	NC	= No connection	26.	(925)	= Wire colors are given by numbers in parentheses using the resistor color code [(925) is wht-red-grn].
11.		= Waveform test point (with number)			0 - Black 5 - Green 1 - Brown 6 - Blue 2 - Red 7 - Violet 3 - Orange 8 - Gray 4 - Yellow 9 - White
12.		= Common electrical point (with letter) not necessarily ground	27.	*	= Optimum value selected at factory, typical value shown; part may have been omitted.
13.		= Single-pin connector on board	28.		Unless otherwise indicated: resistance in ohms capacitance in picofarads inductance in microhenries
14.		= Pin of a plug-in board (with letter or number)			
15.		= Coaxial cable connected directly to board			
16.		= Wire connected to pressure-fit socket on board			

Table 8-4. Troubleshooting Low Voltage Power Supply

Step	Test Conditions	Indications	Procedures, Checks, Probable Causes
1.	POWER ON SCALE ILLUM cw	Power lamp on Scale lamps on	Check all low voltage outputs. If OK, go to table 8-5. If not, continue.
2.		Power lamp off Scale lamps on	Check following on schematic 21: 1. $\pm 50V$ outputs (fuses). 2. Rectifiers and filters. Check low voltage converter and regulator (schematic 20)
3.		Power lamp on Scale lamp off	Check following on schematic 20: 1. Scale lamps. 2. Scale lamp driver.
4.		Power lamp off Scale lamps off	Refer to note 1. Check following on schematic 19: 1. Ac line fuse A1F1. 2. POWER MODE switch. 3. Dc line fuse F1. 4. Voltage Limiter and battery Regulator. 5. Line Rectifier.
Note 1 At normal ac line voltage, there should be about 33 Vdc at POWER MODE switch.			
5.		Dc line fuse F1 open.	Refer to note 2. Disconnect power cord. Remove LV converter assy A3A2 (schematic 20). Replace fuse and reconnect power cord. 1. Fuse does not open. Check LV converter assy A3A2. 2. Fuse opens. Check low voltage converter protection circuits.
Note 2 If dc input or +15V regulated input to low voltage converter protection circuits is 20% or more, high circuits will activate and open dc line fuse F1. If inputs OK, suspect problem in low voltage converter protection circuits.			

Table 8-4. Troubleshooting, Low Voltage Power Supply (Cont'd)

Step	Test Conditions	Indications	Procedures, Checks, Probable Causes
6.		No low voltage outputs.	Refer to note 3; then: 1. If outputs within $\pm 10\%$, check low voltage regulator (schematic 20). 2. If no outputs, check low voltage (schematic 20). 3. If no voltage from any single output, check: a. Lead on that output. b. Rectifier and filter for that output (schematic 21).
7.	Battery operation only.	Power lamp flashing.	Battery output too low. Recharge before further battery operation.
Note 3 With 24-Vdc input to low voltage converter, all outputs should be within $\pm 10\%$ of normal with regulator disconnected. Disconnect regulator by lifting either end of A3A2R16 or A3A2L1. Use variac in ac line to set 24 Vdc to POWER MODE switch. When setting 24 Vdc, set variac for normal line; then lower voltage: otherwise, dc line fuse will open.			

Table 8-5. Troubleshooting High Voltage Power Supply, CRT, Gate

Step	Test Conditions	Indications	Procedures, Checks, Causes																				
1.	Controls set per note 1.	Beam on screen Intensity controllable	Assume low voltage power supply, high voltage power supply, CRT, and gate amplifier OK. Step 2.																				
Note 1 <table> <tr> <td>POWER</td><td>ON</td> <td>HORIZONTAL POSITION</td><td>centered</td> </tr> <tr> <td>INTENSITY</td><td>2 o'clock</td> <td>VERTICAL POSITION</td><td>centered</td> </tr> <tr> <td>FOCUS</td><td>centered</td> <td>vertical VOLTS/DIV</td><td>5</td> </tr> <tr> <td>INT/EXT</td><td>EXT</td> <td>vertical vernier</td><td>CAL</td> </tr> <tr> <td>X1/X10</td><td>X1</td> <td>main VERNIER</td><td>cw</td> </tr> </table>				POWER	ON	HORIZONTAL POSITION	centered	INTENSITY	2 o'clock	VERTICAL POSITION	centered	FOCUS	centered	vertical VOLTS/DIV	5	INT/EXT	EXT	vertical vernier	CAL	X1/X10	X1	main VERNIER	cw
POWER	ON	HORIZONTAL POSITION	centered																				
INTENSITY	2 o'clock	VERTICAL POSITION	centered																				
FOCUS	centered	vertical VOLTS/DIV	5																				
INT/EXT	EXT	vertical vernier	CAL																				
X1/X10	X1	main VERNIER	cw																				
2.	Check vertical and horizontal deflection sensitivity.	Both deflection sensitivities OK. Both deflection sensitivities out of tolerance (refer to note 2)	Assume vertical and horizontal amplifiers OK. Go to table 8-8. Check output of high voltage power supply. Go to step 7.																				
Note 2 If output of high voltage power supply is too high, both deflections will be contracted. If output is too low, both deflections will be expanded (usually accompanied by poor focus).																							
3.		No beam	Depress BEAM FINDER: Beam near center horizontally, but deflected up or down. Go to table 8-6, step 3. Beam near center vertically, but deflected right or left. Go to table 8-7, step 2. Beam near center both vertically and horizontally: Check intensity level. Check input to gate amplifier from horizontal preamplifier. No beam: Check high voltage fuse. Check high voltage oscillator. Check CRT (filament, cathode). Check gate amplifier.																				
4.		Beam on but no intensity control.	Set FOCUS control cw to prevent CRT damage. Remove brown wire from gate amplifier square pin connector to A3A4R19 and connect to ground. Vary INTENSITY LIMIT ADJ. Intensity controllable - problem in gate amplifier. Intensity not controllable - Refer to note 3 and go to step 5.																				
Note 3 Remove input power and discharge high voltage points. Remove 7 square pin connections from high voltage board and remove high voltage board. Lay board on top of power supply module with multiplier side down. Reconnect 7 square pins. Using caution, power can now be restored with board in position for servicing.																							

Table 8-5. Troubleshooting High Voltage Power Supply, CRT, Gate (Cont'd)

Step	Test Conditions	Indications	Procedures, Checks, Causes
5.		Beam on but no intensity control. Gate amplifier OK.	Using floating meter not connected to power line, measure voltage drop across A3A4R18. 0 volt - grid circuit open. Check wires and connections. Check CRT socket. Check CRT. Check A3A4CR7 (open). 2 volts - excessive grid current. Check CRT (note 4). Check DS1, DS2, CR9, C21.
Note 4 To check for CRT leakage, remove CRT socket. If voltage drop across A3A4R18 disappears, CRT is leaky. If voltage drop remains, leave CRT socket off, while troubleshooting, to protect CRT.			
6.	Depress BEAM FINDER.	No beam	Measure cathode potential: Potential OK: Check grid potential - if OK and controllable, suspect open CRT. If grid potential improper, check grid supply circuit and gate amplifier. No potential: Check high voltage fuse. Check high voltage oscillator waveform.
7.	Depress BEAM FINDER	Beam on. Some intensity control. Improper deflection sensitivity.	Measure cathode potential: Voltage low; unable to adjust up (deflections expanded). Check A3A4R2, 3, 4, 5 - suspect change to lower value. Remove CRT socket - if voltage remains low, check filter capacitors for leakage. Check error amplifier. Check oscillator waveform: If OK and no leakage in CRT or filter capacitors, suspect HV transformer. Voltage high; unable to adjust down (deflections contracted). Check A3A4R2, 3, 4, 5 - suspect change to higher value. Check error amplifier. Voltage high and no control (up or down). Suspect A3A4R2, 3, 4, or 5 open.

Table 8-5. Troubleshooting High Voltage Power Supply, CRT, Gate (Cont'd)

Step	Test Conditions	Indications	Procedures, Checks, Causes
8.		Intermittent flicker.	Check for visible or audible arcing. Check for intermittent operation of error amplifier or oscillator. Suspect intermittent open: - Wire and connections between high voltage circuits and CRT socket. - CRT socket. - Feedback loop to error amplifier. Suspect breakdown: - High voltage transformer. - Filter capacitors. - CRT.

Step	Test Conditions	Indications	Procedures, Checks, Causes																				
1.	Controls set per note 1.	Beam on. Positioning OK. Deflection sensitivity OK.	Assume channel A preamplifier and vertical output amplifier OK. Go to step 2.																				
Note 1 Set controls as follows: <table> <tr> <td>POWER</td> <td>ON</td> <td>HORIZONTAL POSITION</td> <td>centered</td> </tr> <tr> <td>INTENSITY</td> <td>normal</td> <td>DISPLAY</td> <td>A</td> </tr> <tr> <td>FOCUS</td> <td>normal</td> <td>VOLTS/DIV (A and B)</td> <td>5</td> </tr> <tr> <td>INT/EXT</td> <td>EXT</td> <td>vertical POSITION</td> <td>centered</td> </tr> <tr> <td>X1/X10</td> <td>X1</td> <td>verniers</td> <td>CAL</td> </tr> </table>				POWER	ON	HORIZONTAL POSITION	centered	INTENSITY	normal	DISPLAY	A	FOCUS	normal	VOLTS/DIV (A and B)	5	INT/EXT	EXT	vertical POSITION	centered	X1/X10	X1	verniers	CAL
POWER	ON	HORIZONTAL POSITION	centered																				
INTENSITY	normal	DISPLAY	A																				
FOCUS	normal	VOLTS/DIV (A and B)	5																				
INT/EXT	EXT	vertical POSITION	centered																				
X1/X10	X1	verniers	CAL																				
2.	DISPLAY - B	Same as step 1.	Assume vertical section OK. Go to table 8-7.																				
3.	Set controls per note 1.	No beam (chan A).	Depress BEAM FINDER: Beam deflected up or down and unable to position. Check channel B; beam on. Check channel A preamplifier Channel B beam deflected same direction. Suspect feedback amplifier, delay line driver, or output amplifier. Refer to note 2.																				
Note 2 Do not discount the possibility that the user overloaded one channel, causing a preamplifier problem; then put the same signal into the other channel, causing the same problem in that preamplifier (refer to step 4).																							
4.		Beam deflected up or down (A and B).	Short inputs to output amplifier together: Beam on - assume output amplifier OK. Beam still deflected - Problem in output amplifier. Short bases of A5A4Q32 and A5A4Q33 Beam on - delay line driver OK. Beam still deflected - problem in delay line driver.																				
5.		Beam deflected up or down (A or B).	Short bases of A5A4Q9 and A5A4Q10 (or A5A4Q11 and A5A4Q12) together: Beam on - differential amplifier and channel switch OK. Beam still deflected - Problem in differential amplifier, channel switch, or feedback amplifier.																				

Table 8-6. Troubleshooting Vertical Deflection (Cont'd)

Step	Test Conditions	Indications	Procedures, Checks, Causes
Note 3 The methods used in steps 3, 4, and 5 can also be used to help locate problems of trace bounce or drift.			
Note 4 The following steps are dependent on proper horizontal and sweep operation. If there is also a horizontal or sweep problem, it must be repaired first.			
6.	Change controls per note 5.	Gain or pulse response out of tolerance.	Check preamplifier for that channel.
Note 5 Change controls as follows: main INT/EXT INT DISPLAY A or B main sweep time as required VOLTS/DIV (A or B) as required main TRIGGER LEVEL as required			
7.		Gain or pulse response out of tolerance (both channels).	Assume problem in output circuitry common to both channels. Use waveforms adjacent to schematics to help locate problem. Also refer to note 2.
8.	TIME/DIV 1MS AUTO/NORM... AUTO DISPLAY ALT	No alternate traces (only one channel on).	Check for alternate trigger to pins 1 and 13 of A5A4U1A. Check A5A4U1, A5A4U2, A5A4Q34, A5A4Q35, and channel switch controls A5A4Q20 and A5A4Q21.
9.	DISPLAY CHOP	No chop.	Check A5A4U1, A5A4U2, A5A4Q34, A5A4Q35, and channel switch controls A5A4Q20 and A5A4Q21.
10.		No chop blanking.	Check A5A4U2, A5A4Q34, A5A4Q35, A5A4Q20 and A5A4Q21.
11.	DISPLAY A+B	No A+B operation (only one channel displayed).	Check A5A4U2, A5A4Q36, A5A4Q37, A5A4Q20, and A5A4Q21.
12.	main INT/EXT ... INT	No internal sync channel A.	Check composite sync. If OK, assume problem in channel A sync amplifier.
13.		No composite sync.	Check channel A sync. If OK, assume problem in composite sync take-off A5A4Q30 and A5A4Q31.

Step	Test Condition	Indications	Procedures, Checks, Causes
14.	No INT sync.	No INT sync.	Check CHAN A SYNC ZERO ADJ and COMPOSITE SYNC ADJ. Check lead from display switch S2 to A6A2 and INT/EXT switch A6A2S1. Check sync take-off amplifier A5A4Q38 and A5A4Q39.

Step	Test Conditions	Indications	Procedures, Checks, Causes																				
1.	Set controls per note 1.	Beam on.	Check deflection sensitivity. If OK, assume external horizontal amplifier, horizontal preamplifier, and output amplifier OK. Go to table 8-8.																				
Note 1 Set controls as follows: <table> <tr> <td>POWER</td><td>ON</td> <td>HORIZONTAL POSITION</td><td>centered</td> </tr> <tr> <td>INTENSITY</td><td>normal</td> <td>DISPLAY</td><td>A or B</td> </tr> <tr> <td>FOCUS</td><td>normal</td> <td>VOLTS/DIV</td><td>5</td> </tr> <tr> <td>INT/EXT</td><td>EXT</td> <td>verniers</td><td>CAL</td> </tr> <tr> <td>X1/X10</td><td>X1</td><td></td><td></td> </tr> </table>				POWER	ON	HORIZONTAL POSITION	centered	INTENSITY	normal	DISPLAY	A or B	FOCUS	normal	VOLTS/DIV	5	INT/EXT	EXT	verniers	CAL	X1/X10	X1		
POWER	ON	HORIZONTAL POSITION	centered																				
INTENSITY	normal	DISPLAY	A or B																				
FOCUS	normal	VOLTS/DIV	5																				
INT/EXT	EXT	verniers	CAL																				
X1/X10	X1																						
2.		No beam.	Depress beam finder: Beam on and centered - check input to gate amplifier (A4CR1). Beam deflected right or left: Short bases of A6A6Q3 and A6A6Q4 together; beam on screen - assume output amplifier OK; Beam deflected - problem in output amplifier. Remove input to A6A9R1 (gray wire to square pin connector) and vary HORIZONTAL POSITION fully cw; beam near center screen - assume horizontal preamplifier OK; Beam deflected - Problem in horizontal preamplifier.																				

Table 8-8. Troubleshooting Time Base

Step	Test Conditions	Indications	Procedures, Checks, Causes																				
1.	Set controls per note 1.	Auto sweep present.	Assume sweep circuits OK. Go to step 9.																				
Note 1 Set controls as follows: <table> <tr> <td>POWER</td><td>ON</td> <td>DISPLAY</td><td>A</td> </tr> <tr> <td>INTENSITY</td><td>normal</td> <td>VOLTS/DIV</td><td>as required</td> </tr> <tr> <td>FOCUS</td><td>normal</td> <td>vertical POSITION</td><td>centered</td> </tr> <tr> <td>INT/EXT</td><td>INT</td> <td>main TIME/DIV</td><td>1 MS</td> </tr> <tr> <td>X1/X10</td><td>X1</td> <td>AUTO/NORM</td><td>AUTO</td> </tr> </table>				POWER	ON	DISPLAY	A	INTENSITY	normal	VOLTS/DIV	as required	FOCUS	normal	vertical POSITION	centered	INT/EXT	INT	main TIME/DIV	1 MS	X1/X10	X1	AUTO/NORM	AUTO
POWER	ON	DISPLAY	A																				
INTENSITY	normal	VOLTS/DIV	as required																				
FOCUS	normal	vertical POSITION	centered																				
INT/EXT	INT	main TIME/DIV	1 MS																				
X1/X10	X1	AUTO/NORM	AUTO																				
2.		No auto sweep.	Measure voltage at collector of A6A2Q26: Approximately +15V. Auto circuit OK. Problem in sweep circuits. Approximately 0V. Lift collector of A6A2Q19 (this turns A6A2Q20 on). Collector of A6A2Q26 now +15V - auto circuit OK. Check A6A2Q19 and A6A2U1. Collector of A6A2Q26 still low - Problem in auto circuit (A6A2Q20 through A6A2Q26).																				
Note 2 Under the test conditions (note 1), and with +15V at the collector of A6A2Q26, there should be an auto sweep. If not, steps 3 through 8 will help locate the problem. Three front panel indicators (reset lamp, beam intensity, and beam position) are used to determine the location of the trouble. If there is no beam on screen, press the BEAM FINDER to locate the beam position.																							
3.		No auto sweep. Reset lamp off. No beam. Beam positioned left.	Check holdoff circuit A6A7Q1, A6A7Q4, A6A7Q7 and associated components. Check set/reset multivibrator A6A3Q3, A6A3U1 and associated components.																				
4.		No auto sweep. Reset lamp off. No beam. Beam positioned right.	Check integrator circuit A6A3Q6, A6A3Q7, A6A3Q8, A6A3Q9 and associated components.																				
5.		No auto sweep. Reset lamp off. Beam on.	Regardless of beam position, repair trouble in sweep gate circuit (A6A3Q1, A6A3CR1 through A6A3CR4), then check for further trouble indications.																				

Step	Test Conditions	Indications	Procedures, Checks, Causes
6.		No auto sweep. Reset lamp on. Beam on.	Same as step 5.
7.		No auto sweep. Reset lamp on. Beam on. Beam to left.	Check integrator circuit A6A3Q6 through A6A3Q9 and associated components.
8.		No auto sweep. Reset lamp on. Beam on. Beam right.	Check comparator circuit A6A3Q2, A6A3Q5 and associated components. Check set/reset multivibrator A6A3Q3, A6A3U1 and associated components.
9.	A ONLY TRIG, inject 2-kHz, 2- div sine wave to channel A.	Presentation triggered.	Check throughout frequency range for stable triggering. Assume trigger circuits OK.
10.		Presentation not triggered.	Change INT/EXT to EXT and inject signal into EXT TRIG INPUT: Triggered - trouble in internal sync circuits. Not triggered - problem in trigger amplifier.

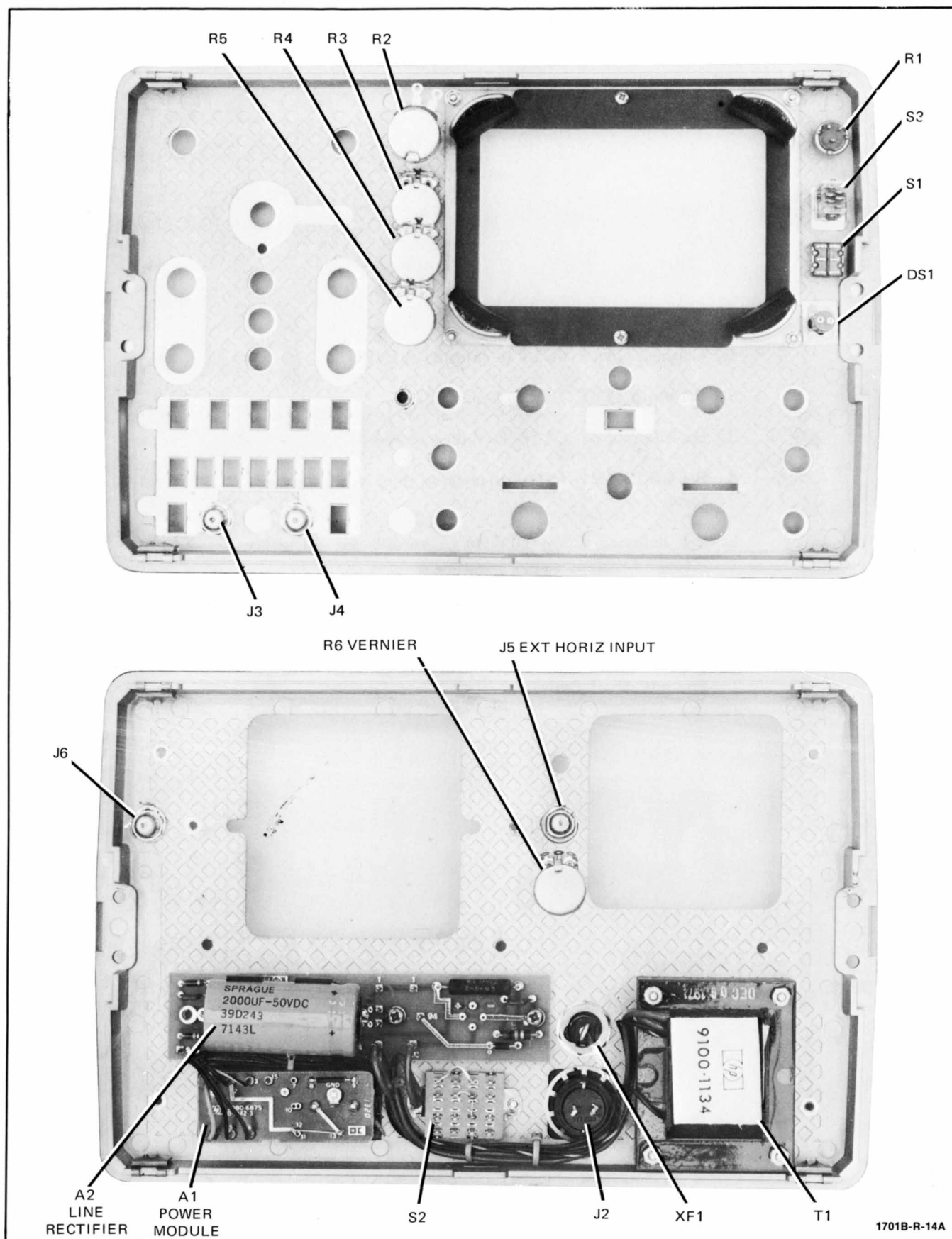


Figure 8-4. Component Identification, Interior Front and Rear Panel

A5A2
75 MHZ
ATTENUATOR

A5A1
75 MHZ
ATTENUATOR

A5
VERTICAL
MODULE

A5A4
VERTICAL
PREAMPLIFIER

A6A9
HORIZONTAL
PREAMPLIFIER

A2
LINE RECTIFIER

A6A1
HORIZON
MOTHER

A6A4
DELAYE
INTEGRA

A6A2
TRIGGER

A6A6
DELAYE

A6A3
MAIN INT

A6A5
MAIN SWI

A6A7
HOLDOFF
COMPAR

A6A8
HORIZON
MODE

A6A9
HORIZON
AMPLIFIE

A3A4
HIGH VOI
OSCILLA

A3A3
LOW VOL
RECTIFIE
AND FILT

P1

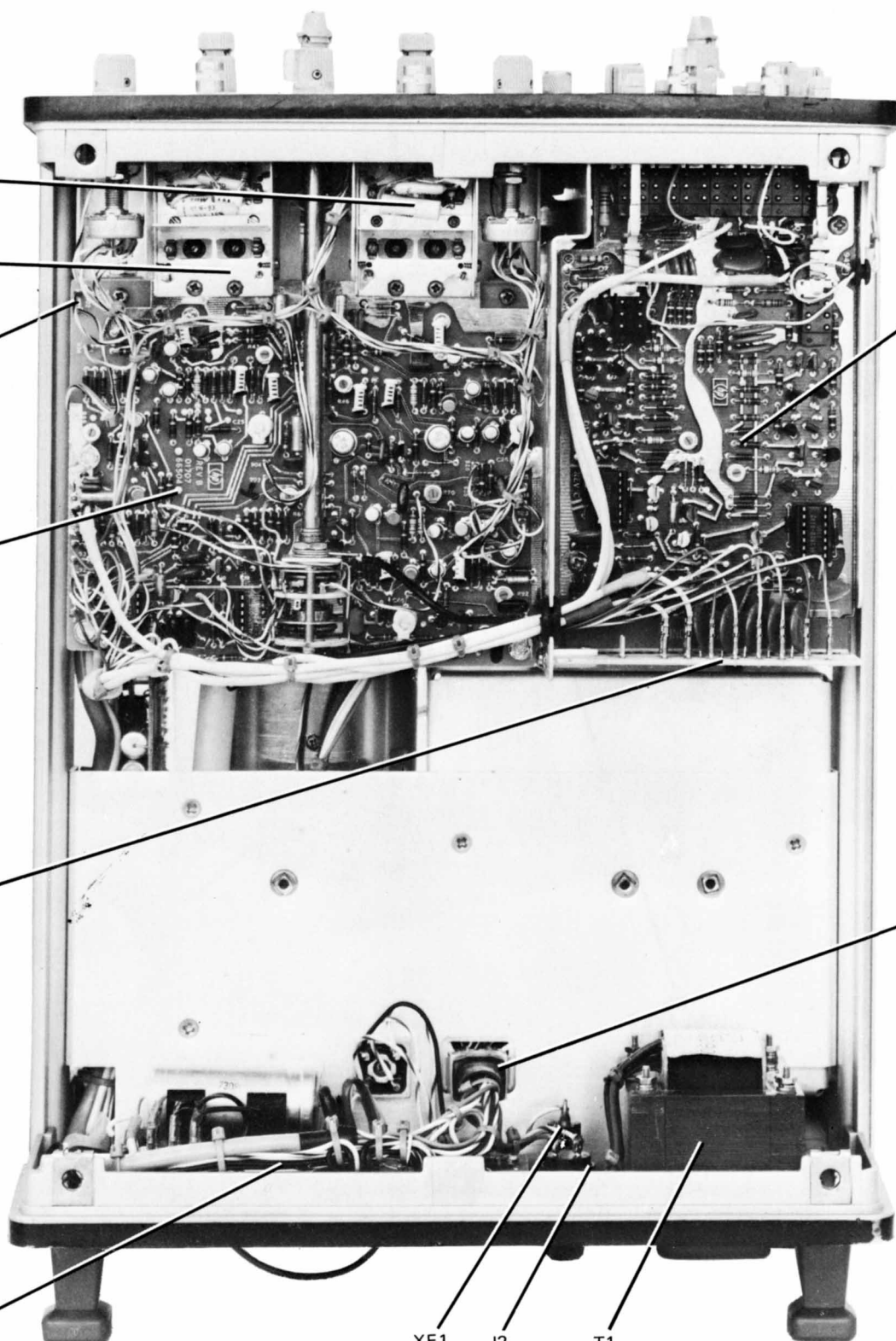
A3A2
LOW VOL
CONVERT

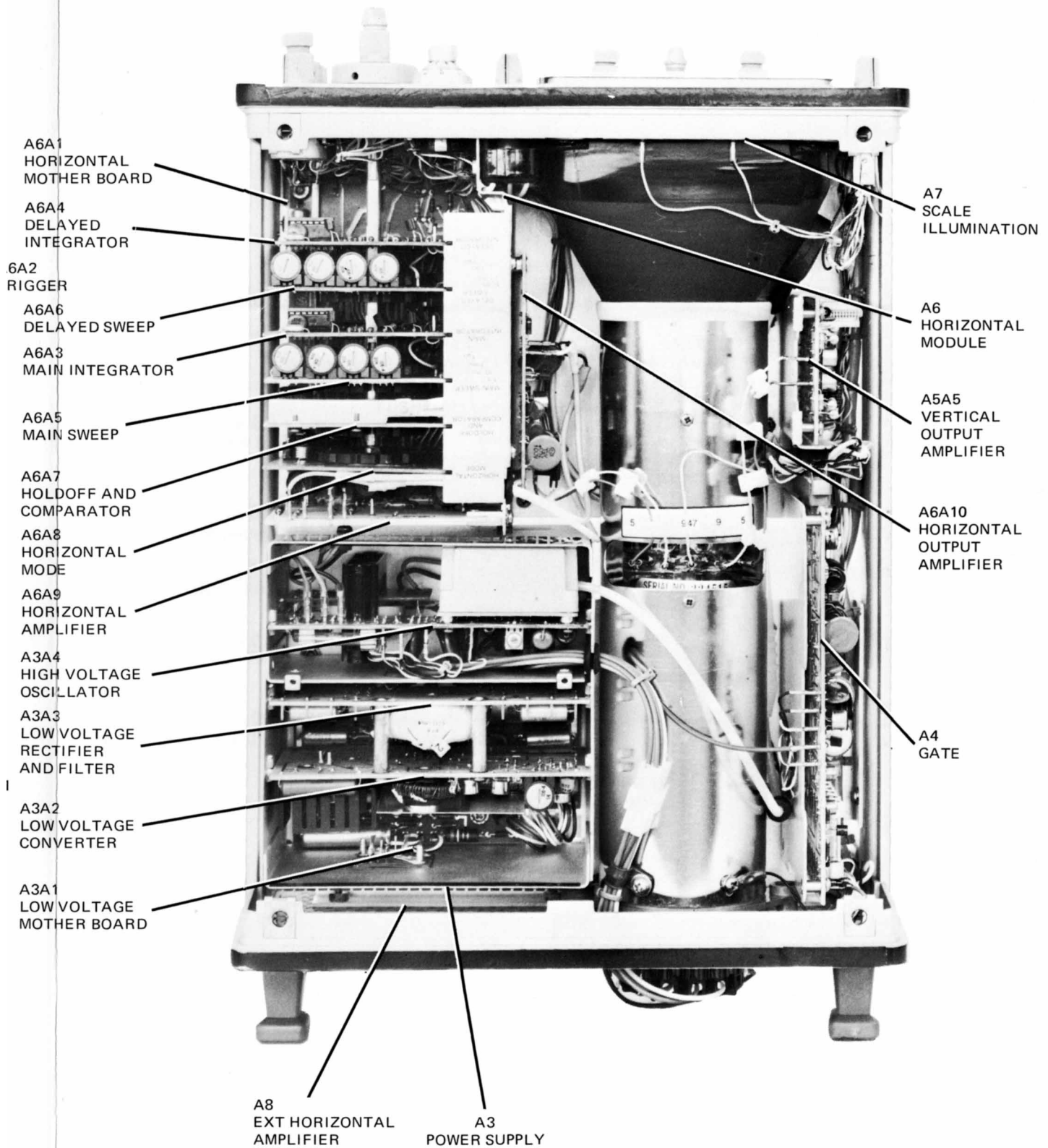
A3A1
LOW VOL
MOTHER

XF1

J2

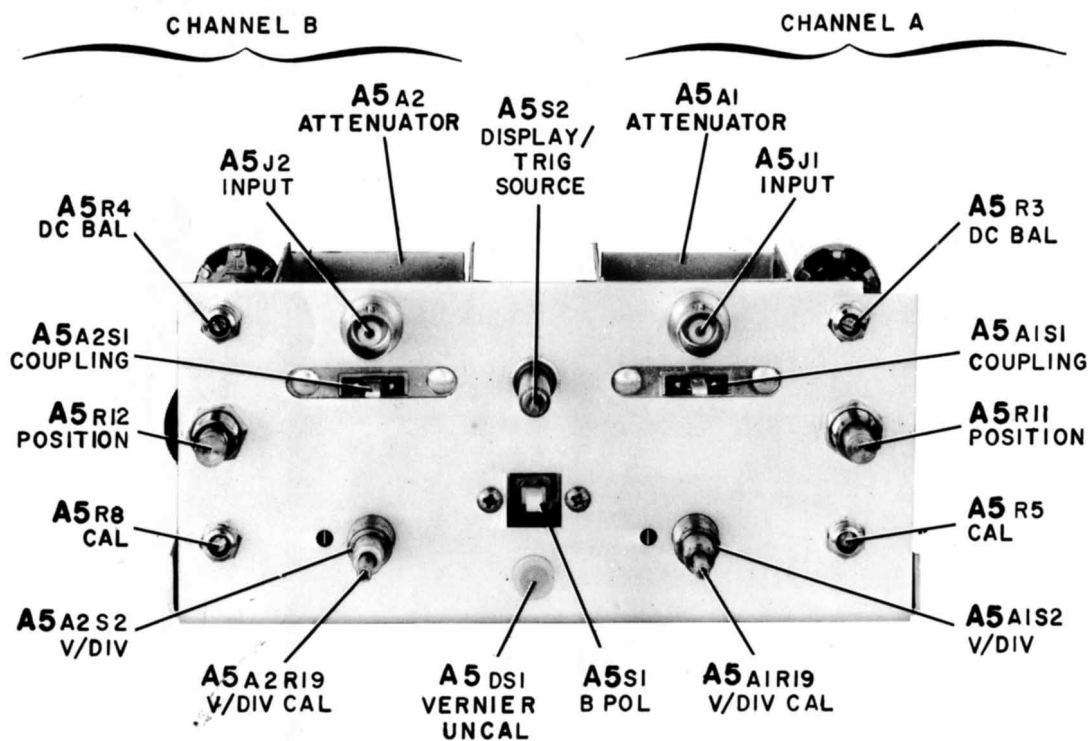
T1





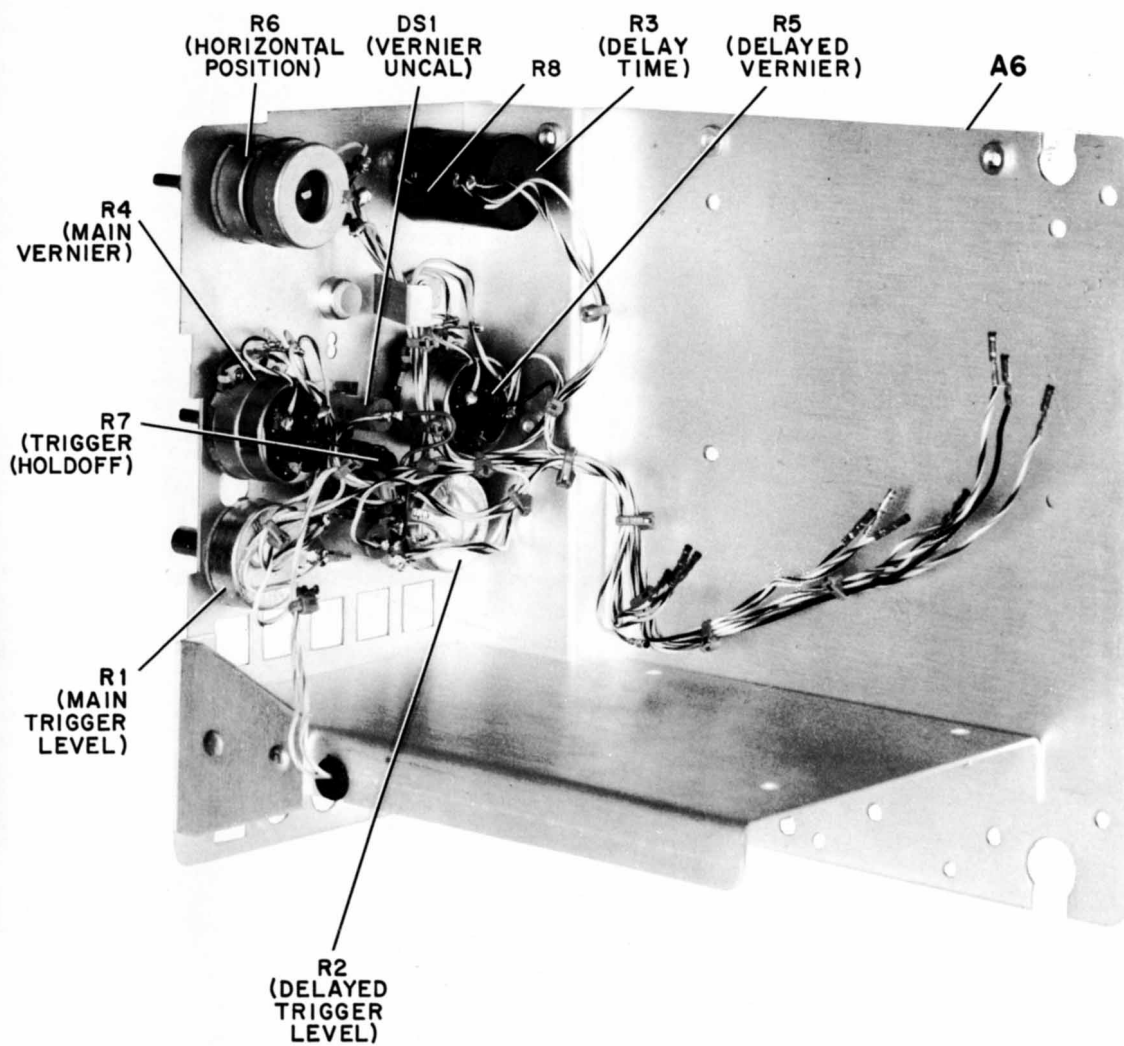
1707B-R-9A

Figure 8-5.
Component and Assembly Locations
8-23



1707B-R-10

Figure 8-6. Vertical Module A5 Component Identification

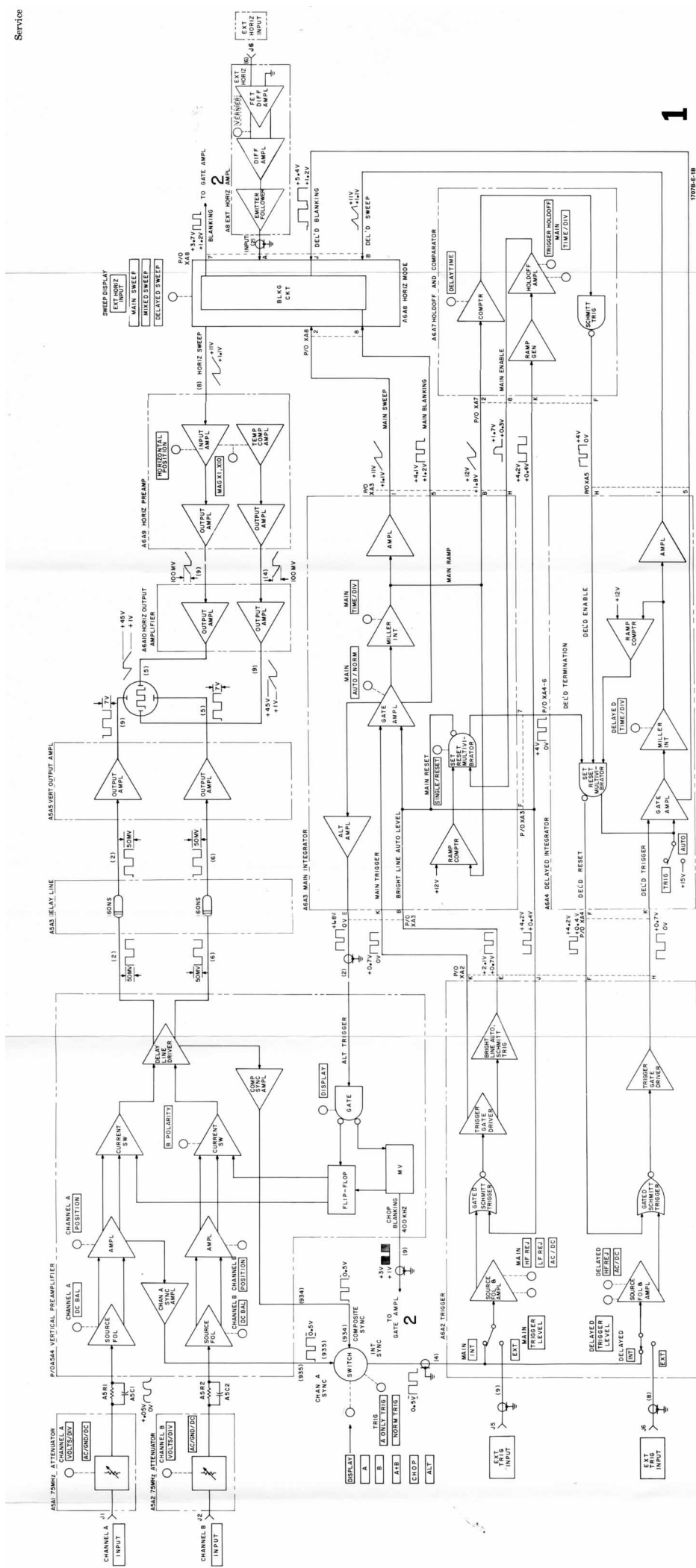


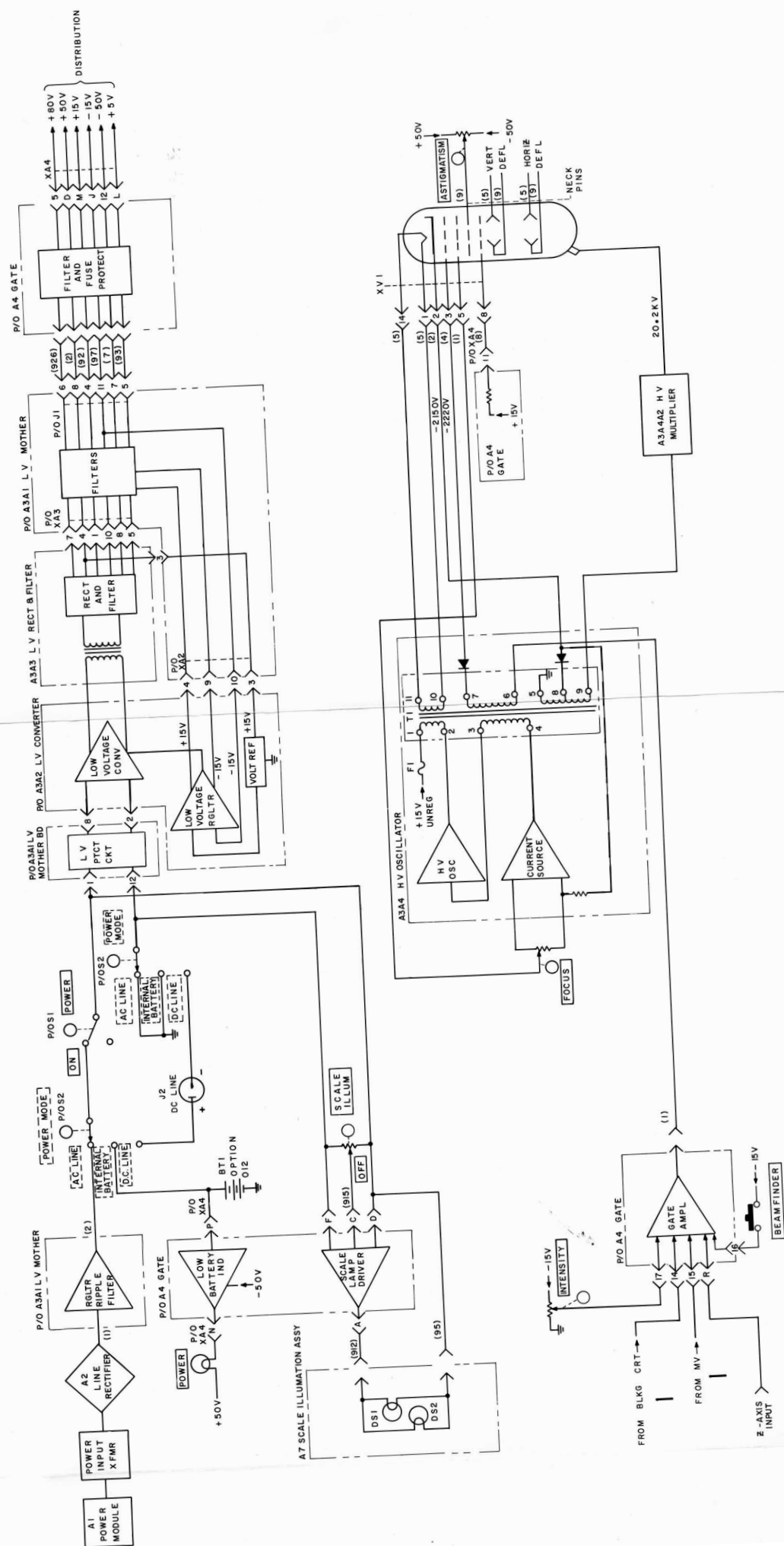
1703A-R-10

Figure 8-7. Horizontal Module A6 Component Identification

Table 8-9. Block Diagram Measurement Conditions

1. Connect CAL 1 VOLT to channel A INPUT.
2. Set main TIME/DIV to 5 mSEC/DIV.
3. Set channel A VOLTS/DIV as required.
4. Set DISPLAY to CHOP to observe chop blanking waveform.
5. Set delayed TIME/DIV to .1 mSEC for all delay measurements.
6. Set delayed AUTO/TRIG to TRIG for delayed trigger waveforms.
7. Remove CAL 1 VOLT input signal to observe bright line auto level signal.

Figure 88.
Main Block Diagram
8-25(8-26 blank)



1107B-D-1

2

Figure 8-9.
Power Supply Block Diagram
8-27

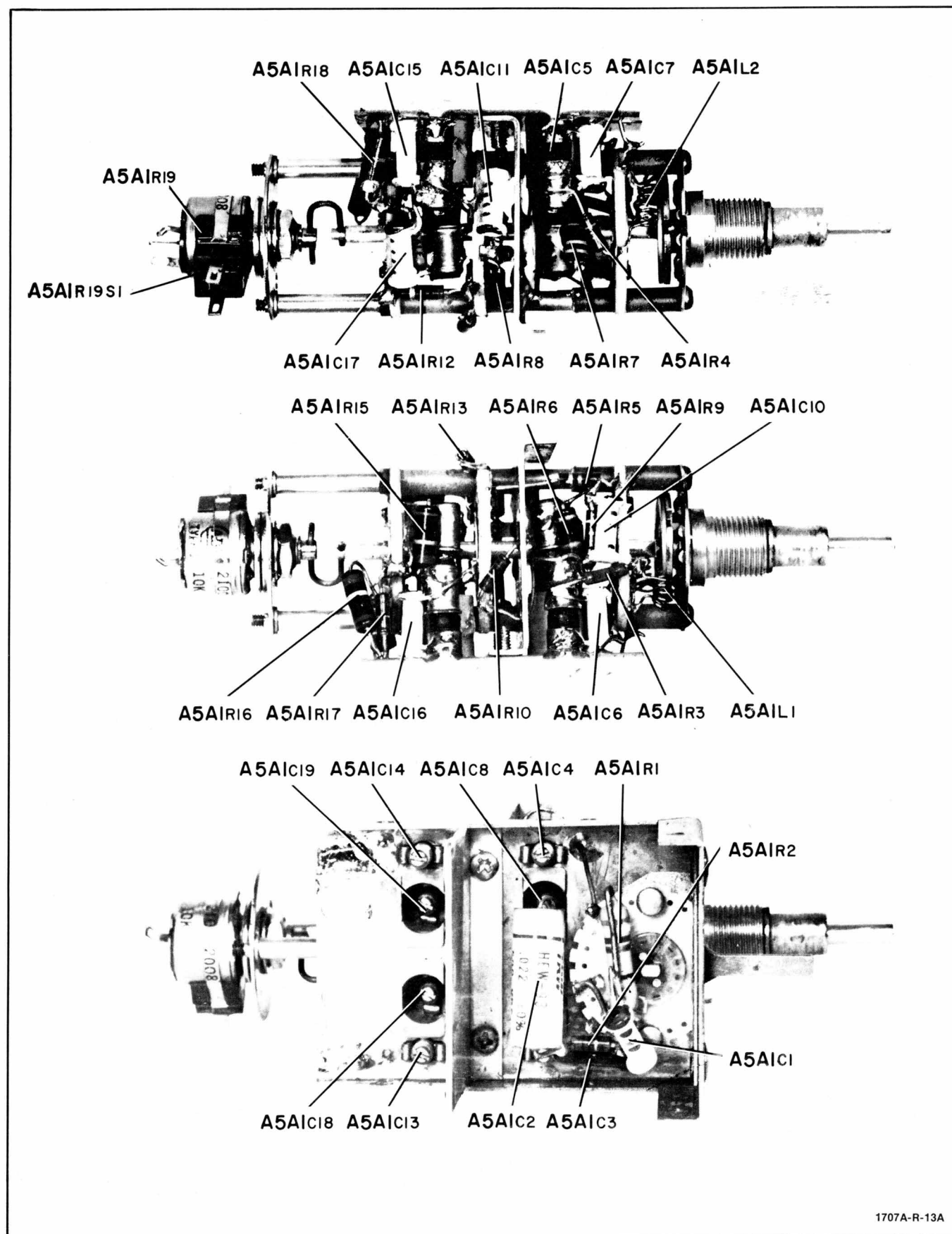
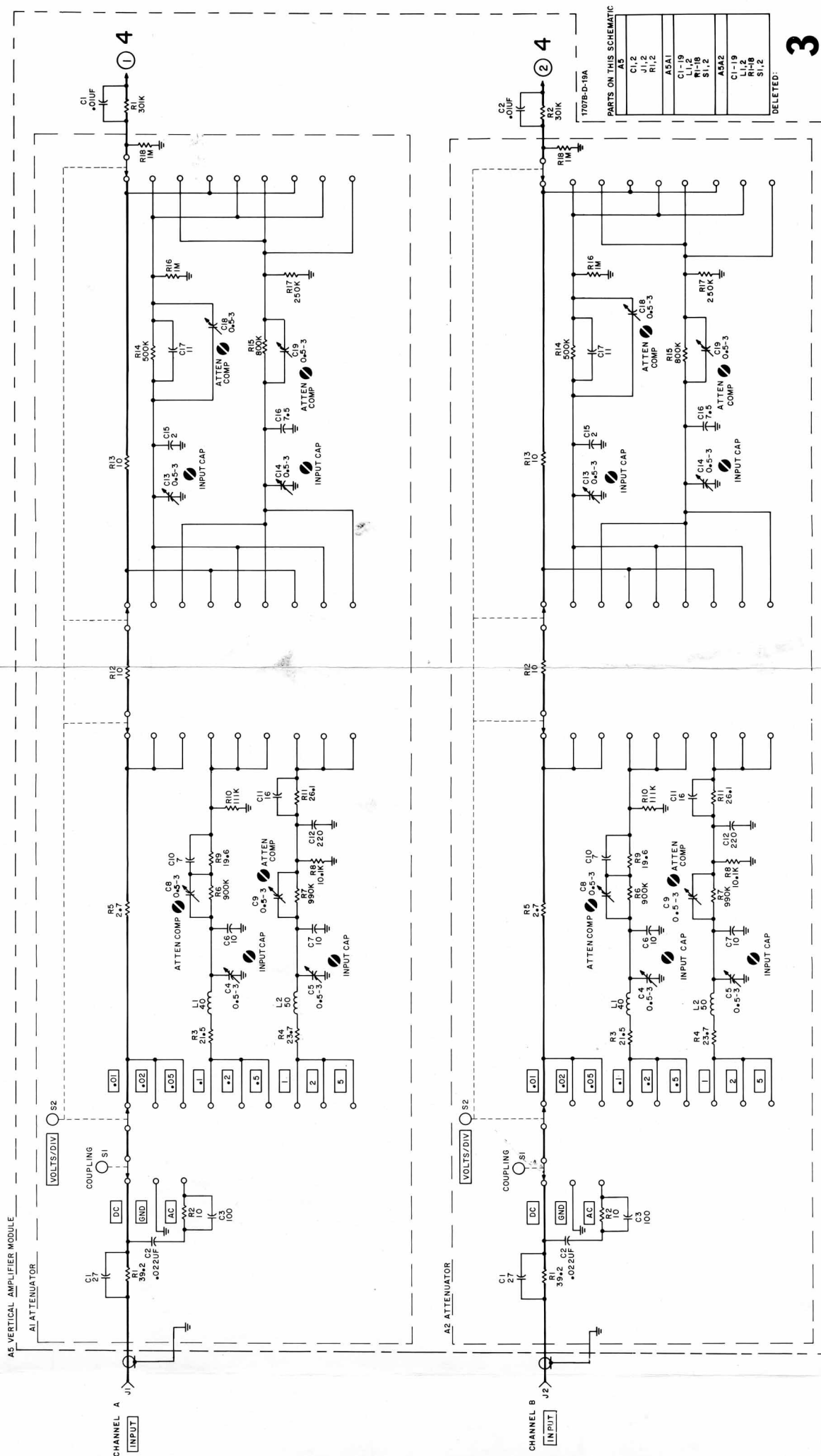


Figure 8-10. Attenuator Component Identification



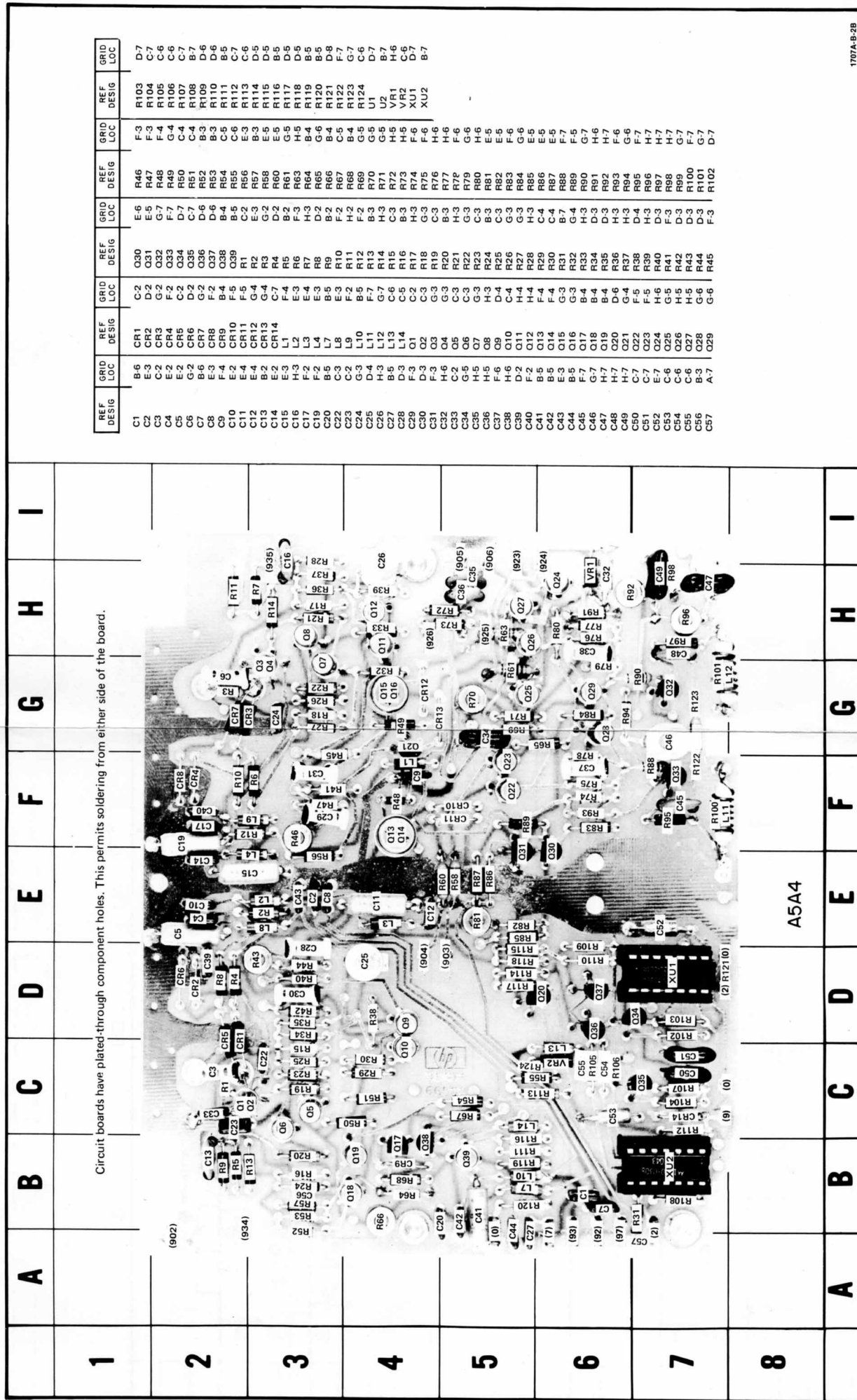


Figure 8-12. Vertical Preamplifier Assembly A5A4 Component Identification

Table 8-10 Schematic 4 Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:

DISPLAY A
 Vertical POSITION (A and B) midrange
 Vertical vernier (A and B) CAL
 VOLTS/DIV (A and B) 2
 Vertical coupling (A and B) GND
 B POL NORM

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

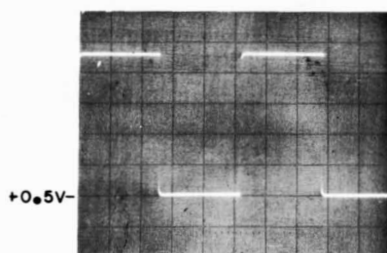
WAVEFORM MEASUREMENT CONDITIONS

1. Set:

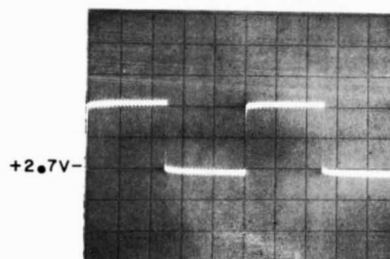
DISPLAY A
 Vertical POSITION (A and B) midrange
 Vertical vernier (A and B) CAL
 VOLTS/DIV (A and B) 2
 Vertical coupling (A) AC
 Vertical coupling (B) GND
 B POL NORM

2. Connect the CAL 1 VOLT signal to channel A INPUT.

3. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.



1 10MV/DIV
 0.2 MSEC / DIV



2 5 MV / DIV

Table 8-11 Schematic 5 Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

Set:

DISPLAY A
 Vertical POSITION (A and B) midrange
 Vertical vernier (A and B) CAL
 VOLTS/DIV (A and B) 2
 Vertical coupling (A and B) GND
 B POL NORM

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

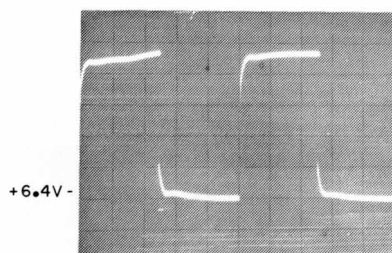
WAVEFORM MEASUREMENT CONDITIONS

Set:

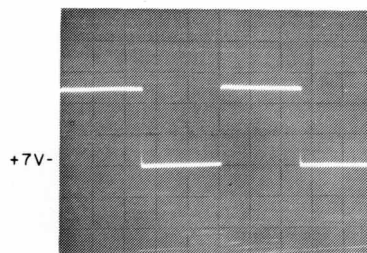
DISPLAY A
 Vertical POSITION (A and B) midrange
 Vertical vernier (A and B) CAL
 VOLTS/DIV (A and B) 2
 Vertical coupling (A) AC
 Vertical coupling (B) GND
 B POL NORM

2. Connect the CAL 1 VOLT signal to channel A INPUT.

3. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.



1 10 MV/DIV
0.2 MSEC/DIV



2 20 MV/DIV
0.2 MSEC/DIV



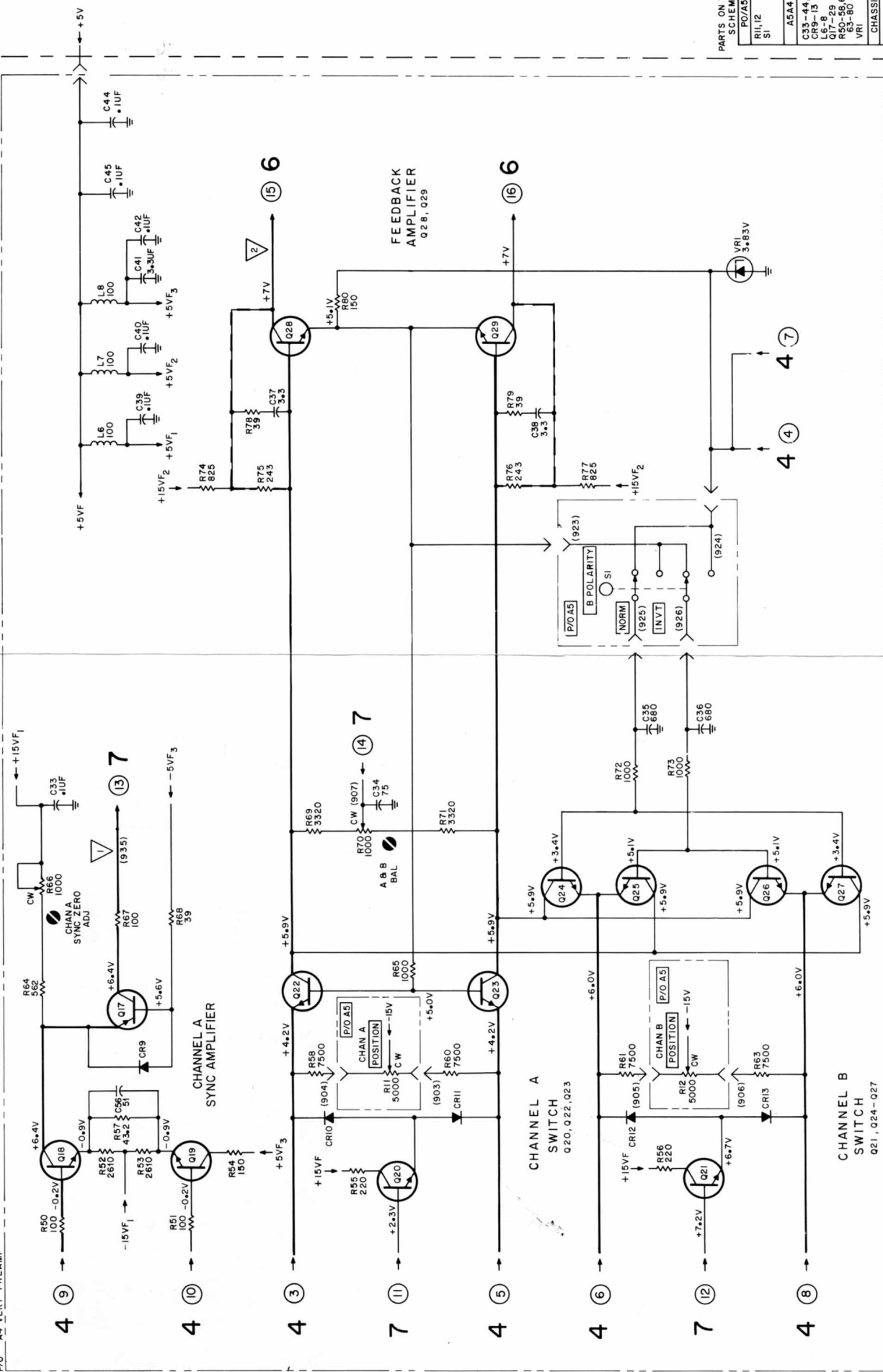
ELETED: A5A4: C18, C21, Q3, Q4,
Q15, Q16: A5: R13, R14

ELETED: A5A4: C18, C21, Q3, Q4,
Q15, Q16: A5: R13, R14

Figure 8-13.
Vertical Preamplifier Assembly A5A4
8-31

P/O A5 VERTICAL AMPLIFIER MODULE

P/O A4 VERT. PREAMP



1707B-D-3B

DELETED/A5A4: R59, R62

5

Figure 8-14.
Vertical Preamp Assembly A5A4
8-33

Table 8-12. Schematic 6 Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

Set:
DISPLAY A
Vertical POSITION (A and B) midrange
Vertical vernier (A and B) CAL
VOLTS/DIV (A and B) 2
Vertical coupling (A and B) GND
B POL NORM

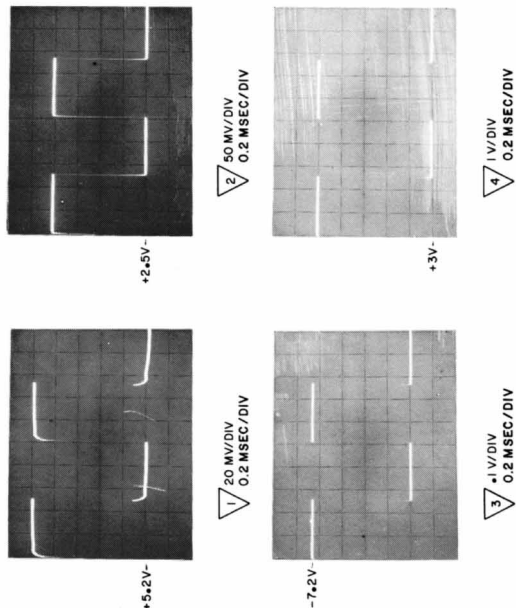
2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

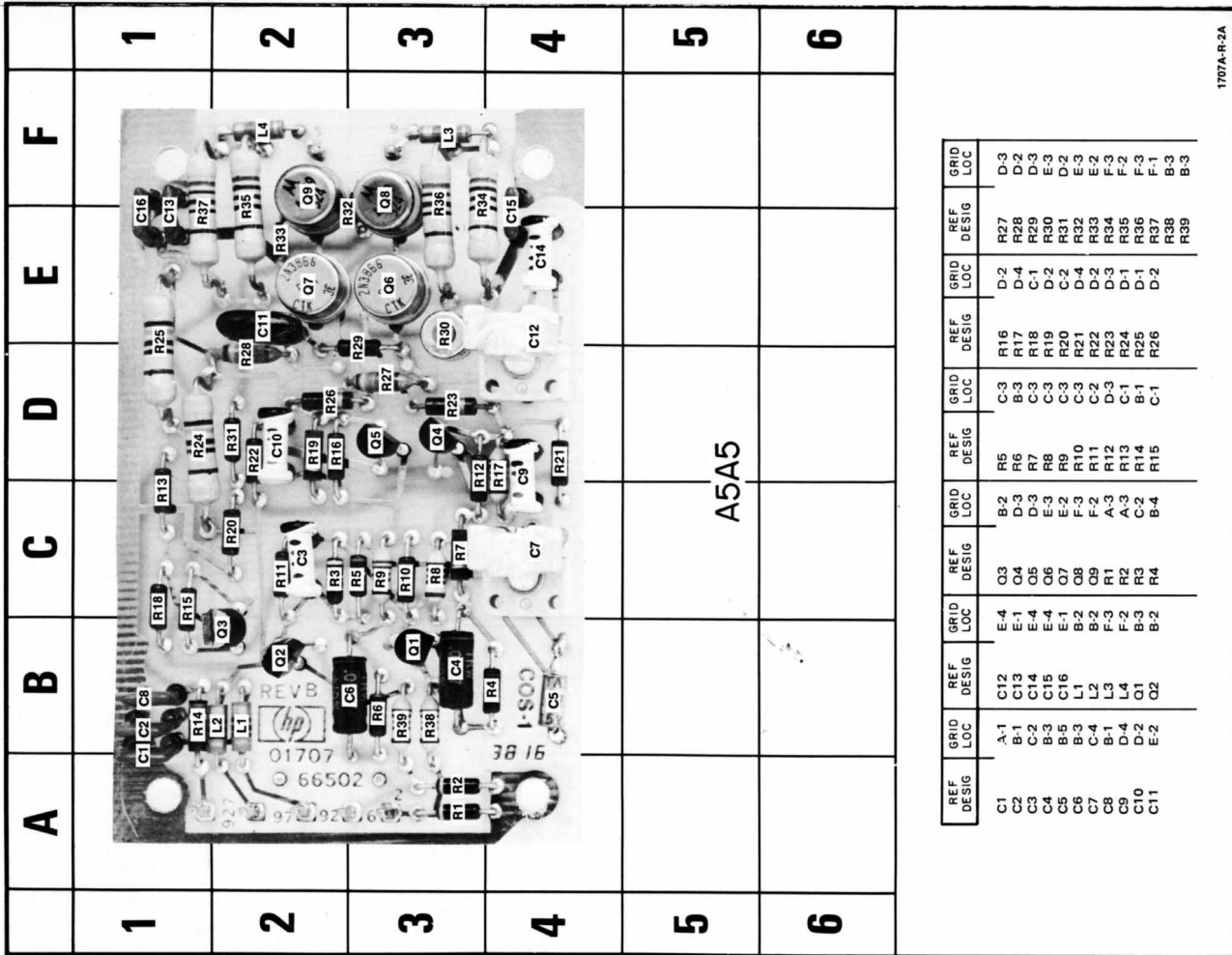
Set:
DISPLAY A
Vertical POSITION (A and B) midrange
Vertical vernier (A and B) CAL
VOLTS/DIV (A and B) 2
Vertical coupling (A) AC
Vertical coupling (B) GND
B POL NORM

2. Connect the CAL 1 VOLT signal to channel A INPUT.

3. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.



1707A-A-2



1707A-R-2A

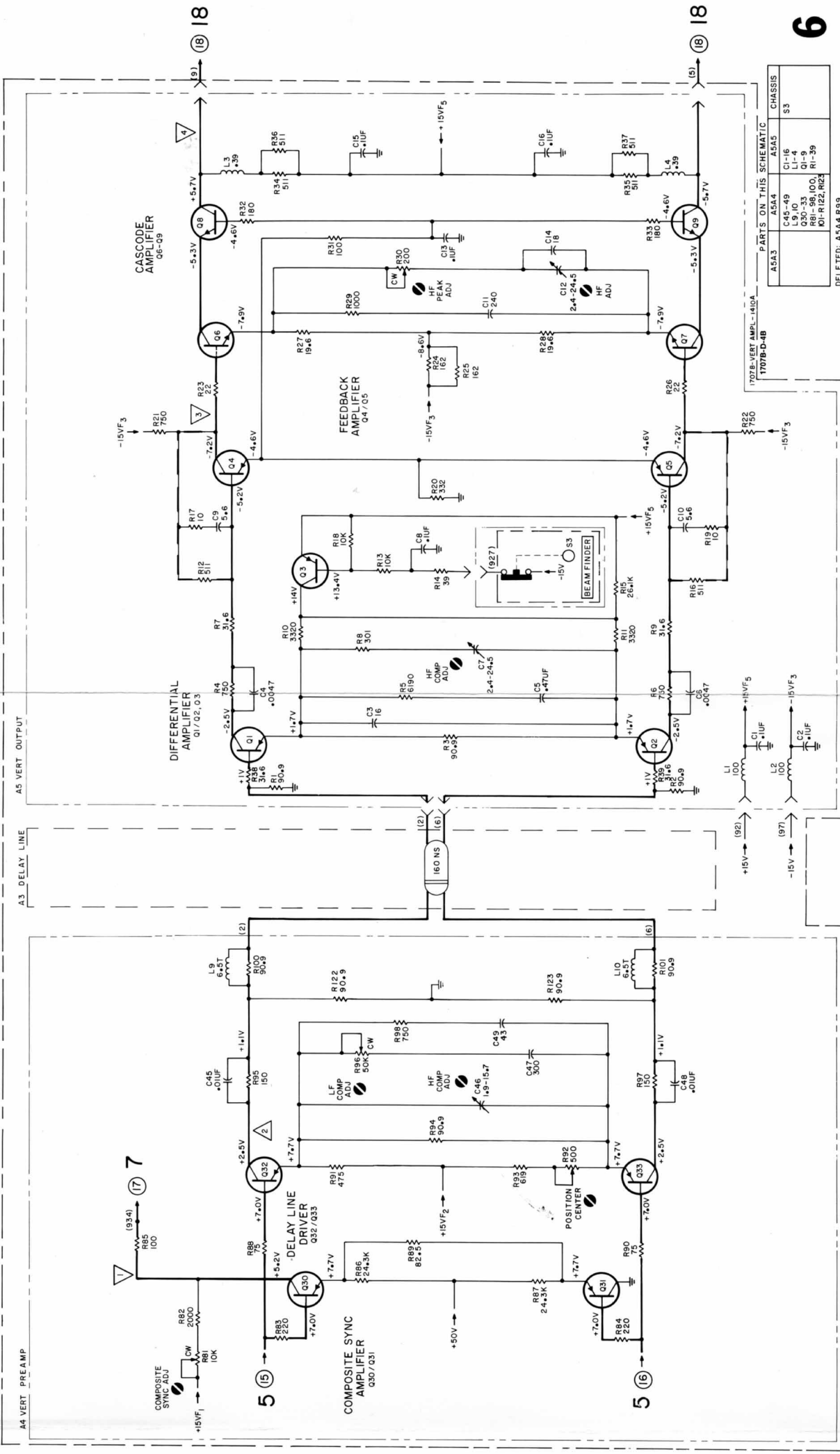
Figure 8-15. Vertical Output Amplifier A5A5 Component Identification

P/O A5 VERTICAL AMPLIFIER MODULE

A4 VERT. PREAMP

A3 DELAY LINE

A5 VERT. OUTPUT



PARTS ON THIS SCHEMATIC

A5A3	A5A4	A5A5	CHASSIS
C45-49	C1-16		S3
R30-33	D1-4		
R81-98, 100, R1-39	DI-R122, R123		

DELETED: A5A4 R99

6

Figure 8-16. Vertical Preamplifier A5A4 and Vertical Output Amplifier A5A5 8-35

Table 8-13. Schematic 7 Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set Model 1707B controls as follows:

DISPLAY..... A
 vertical POSITION (A and B) ... midrange
 vertical vernier (A and B) CAL
 VOLTS/DIV (A and B) 2
 vertical coupling (A and B)..... GND
 B POL..... NORM

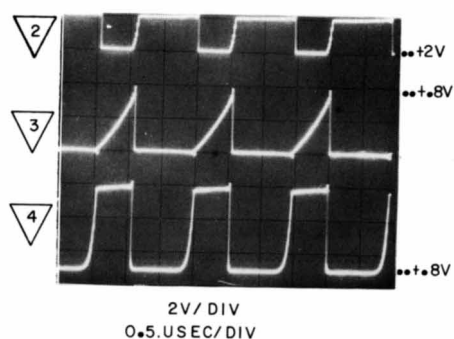
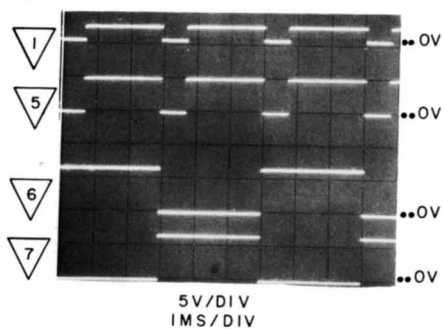
2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

1. Set Model 1707B controls as follows:

DISPLAY..... CHOP
 vertical POSITION (A and B) ... midrange
 vertical vernier (A and B) CAL
 VOLTS/DIV (A and B) 2
 vertical coupling (A and B)..... GND
 B POL..... NORM
 main TRIGGER LEVEL cw
 TRIGGER INT
 TIME/DIV 2 mSEC
 AUTO/NORM..... NORM

2. All waveforms are referenced to chassis ground. Monitor oscilloscope sensitivity (using 1:1 probe) and sweep speed settings are shown below each waveform photograph.



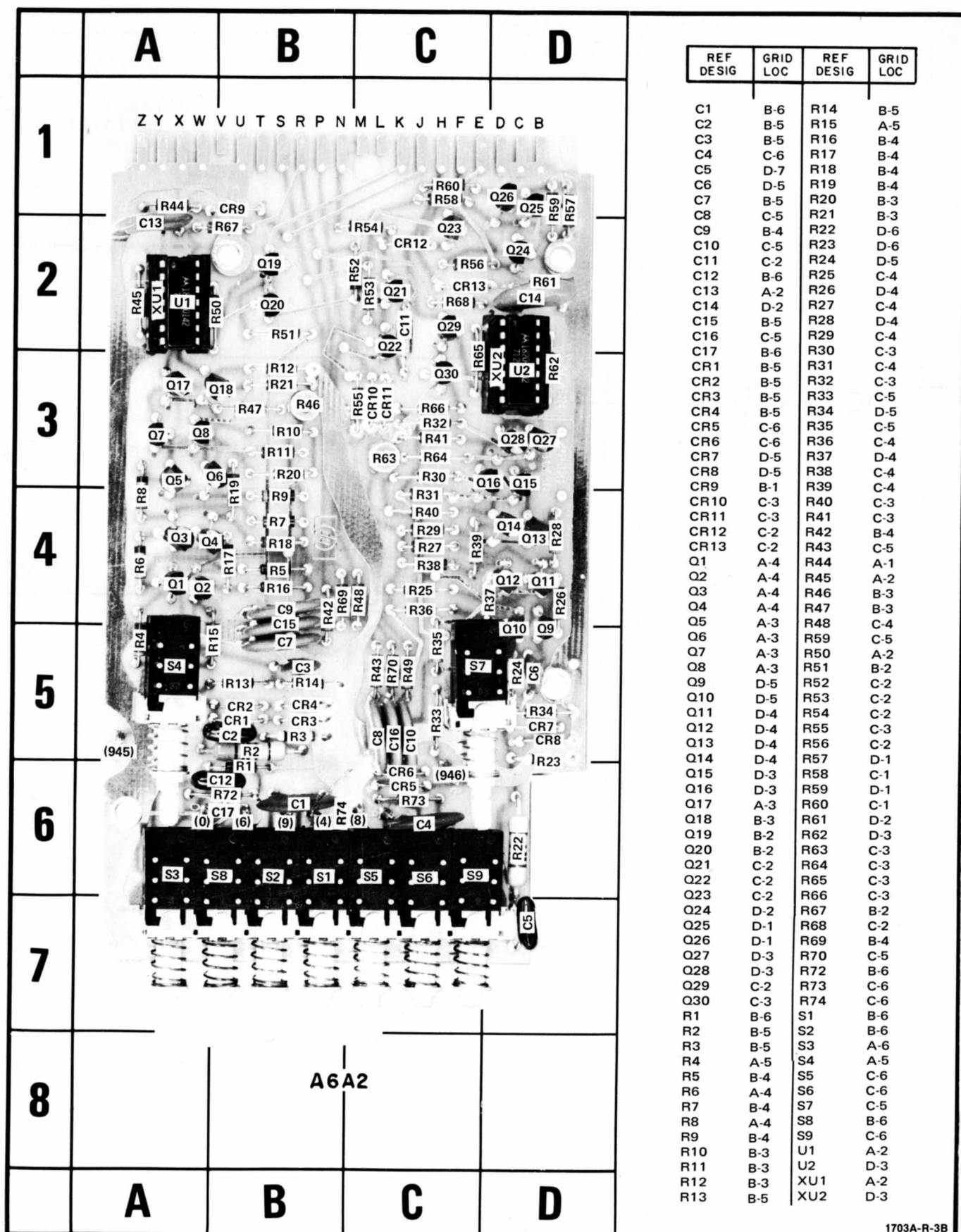


Figure 8-18. Trigger Assembly A6A2 Component Identification

Table 8-14. Schematic 8 Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set Model 1707B controls as follows:

AUTO/NORM AUTO
 SINGLE in
 X1/X10 X1
 main TRIGGER LEVEL cw
 delayed TRIGGER LEVEL cw
 sweep display MAIN

2. All voltages are referenced to chassis ground.

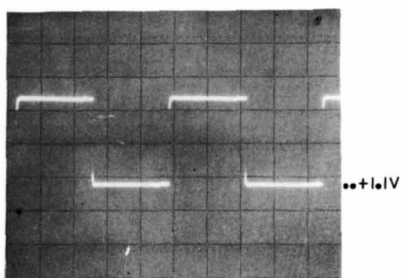
All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

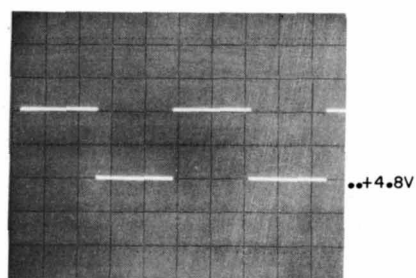
1. Set Model 1707B controls as follows:

AUTO/NORM AUTO
 X1/X10 X1
 sweep display MAIN
 slope +/- +
 TIME/DIV 2 mSEC

2. All waveforms are referenced to ground. Monitor oscilloscope vertical sensitivity (using 1:1 probe) and sweep speed settings are shown below each waveform photograph.



1 • 2V/DIV
 • 2MS/DIV



2 • 2V/DIV
 • 2MS/DIV

P/O A6 HORIZONTAL AMPLIFIER MODULE

P/O A3 TRIGGER

P/O A9 HORIZ PREAMP

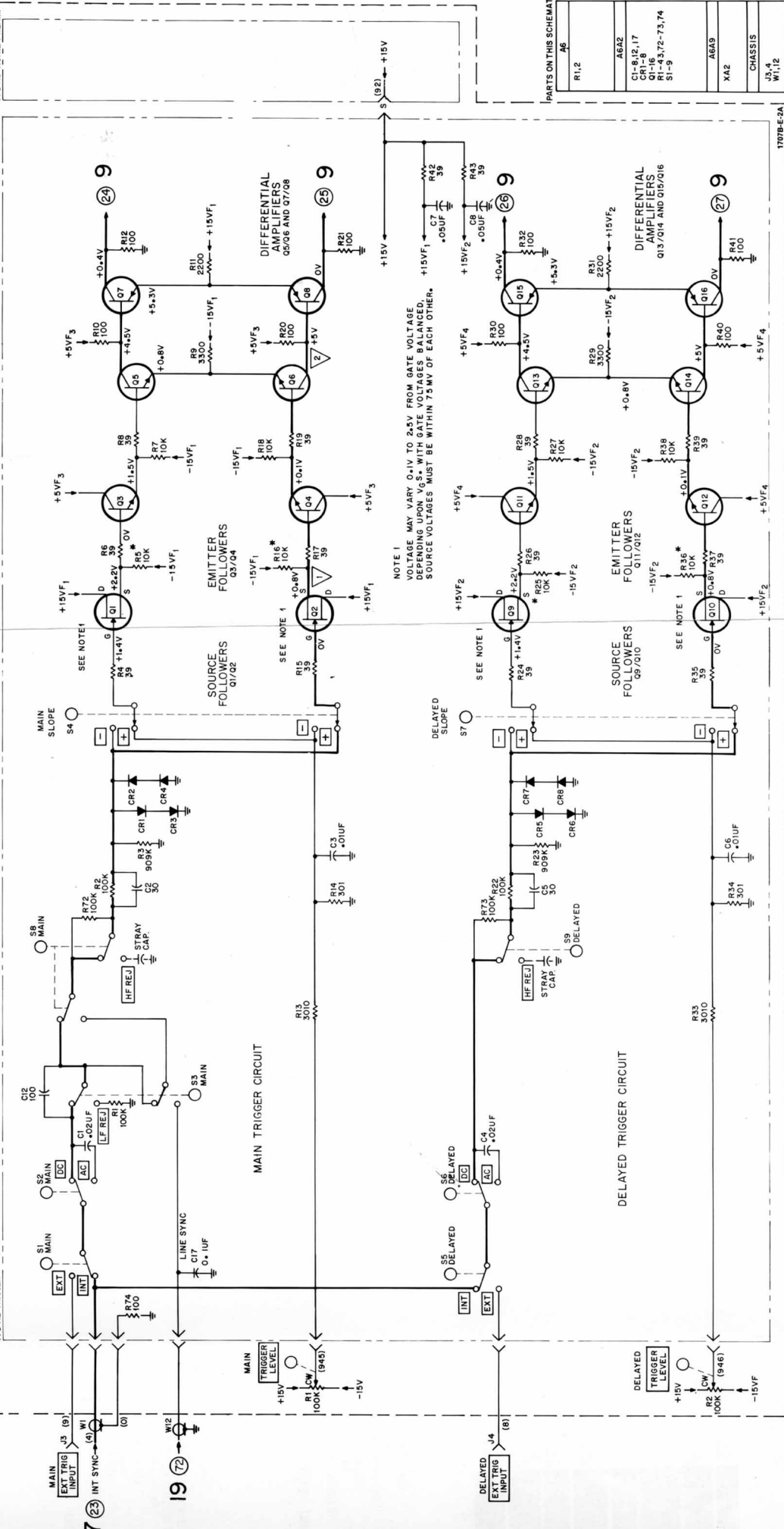


Table 8-15. Schematic 9 Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set Model 1707B controls as follows:

AUTO/NORM..... AUTO
 SINGLE..... in
 X1/X10..... X1
 INT/EXT..... EXT
 sweep display..... MAIN
 main TRIGGER LEVEL..... cw
 delayed TRIGGER LEVEL..... cw

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

1. Set Model 1707B controls as follows:

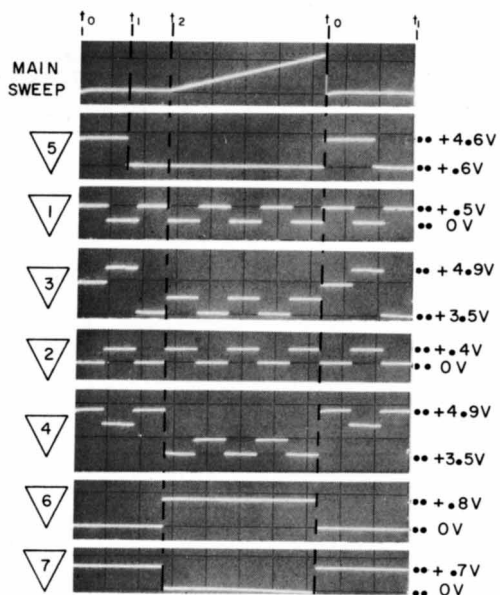
AUTO/NORM..... AUTO
 X1/X10..... X10
 INT/EXT..... EXT
 sweep display..... MAIN
 slope +/-..... +
 TIME/DIV..... .2 mSEC

2. Connect CAL 1 VOLT output to EXT INPUT.

3. Set monitor oscilloscope sweep speed to .5 ms/div.

4. Set vertical sensitivity to display voltages shown to right of each waveform.

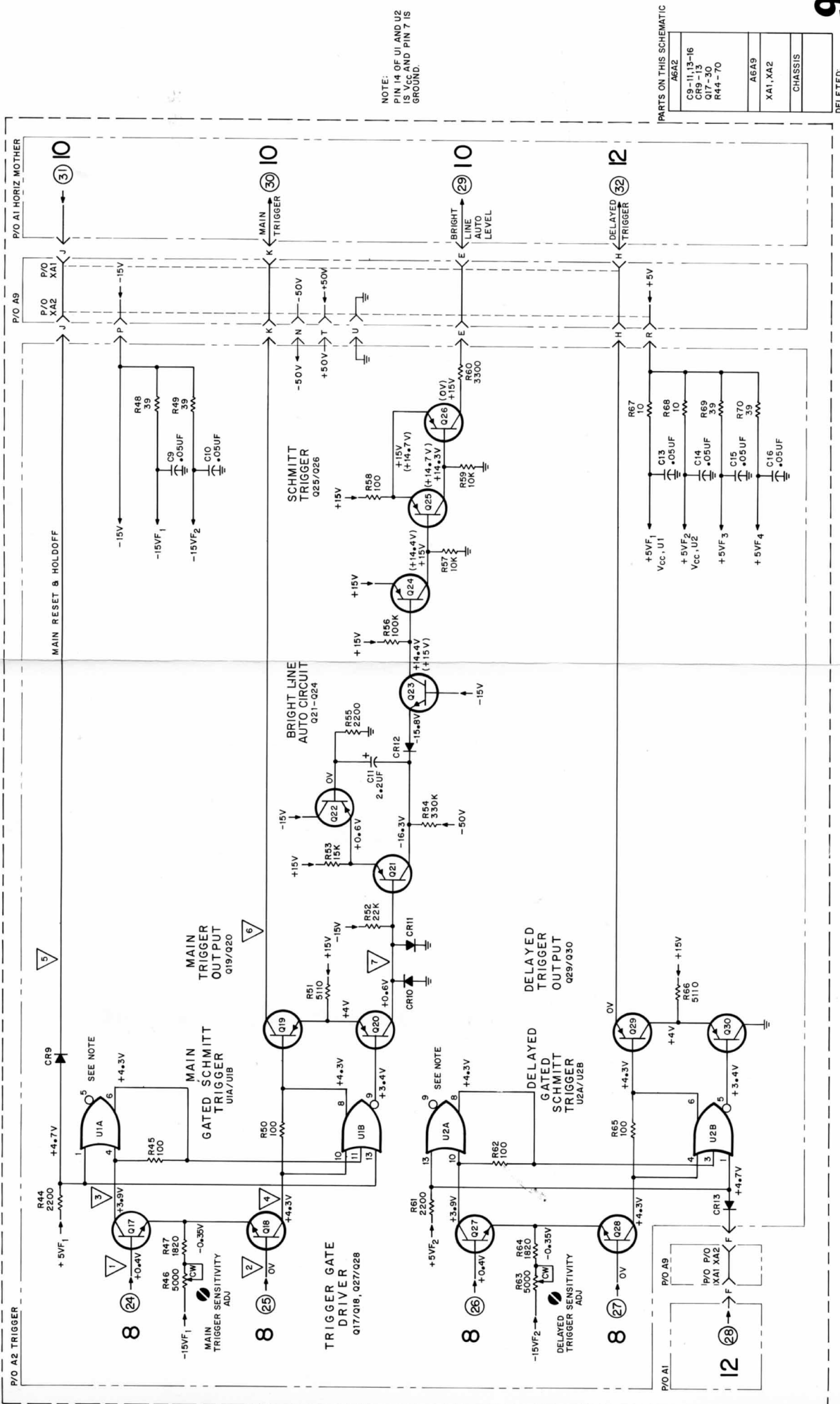
5. All waveforms are referenced to chassis ground.



t_0 - Main sweep terminates.

t_1 - Main enable occurs.

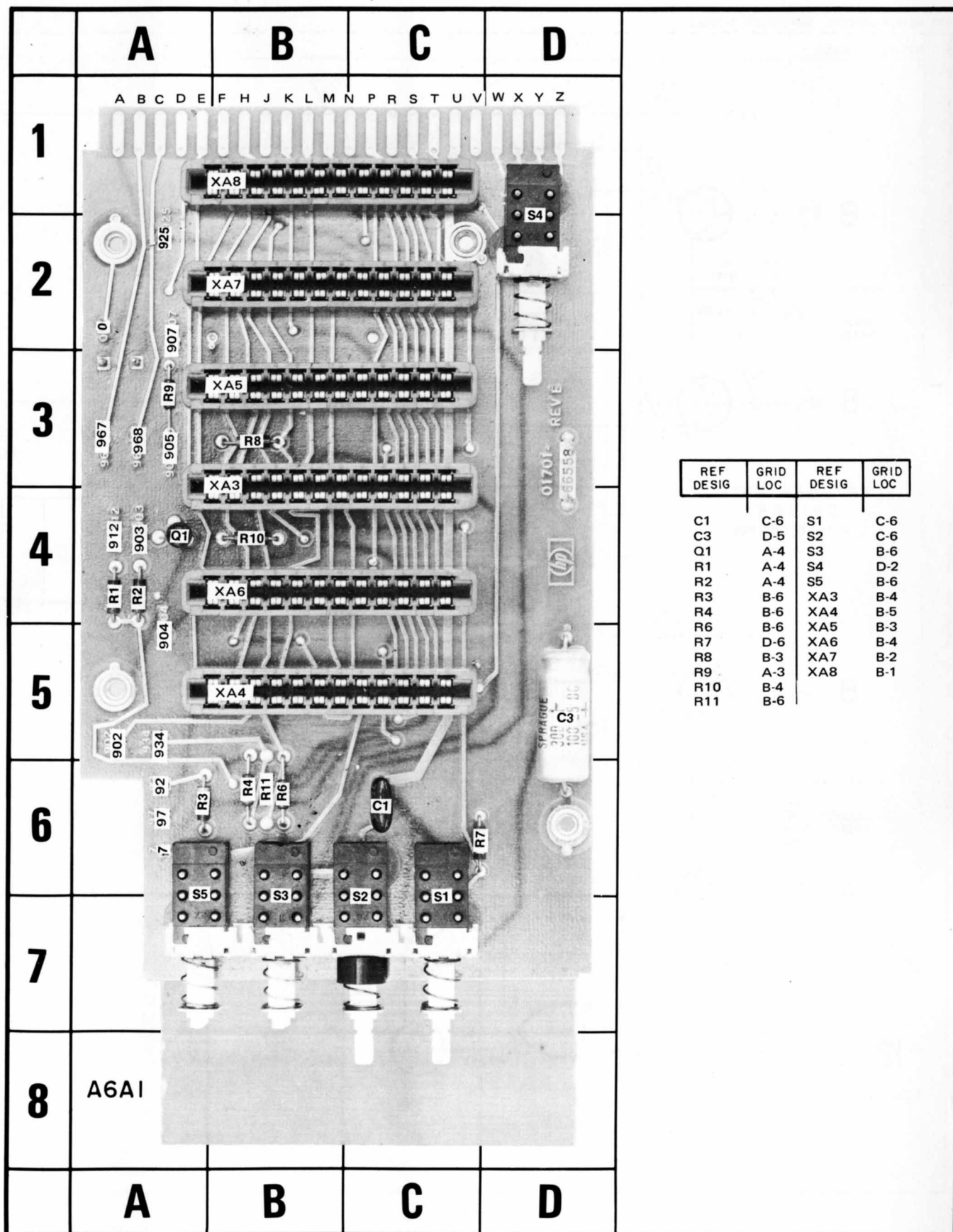
t_2 - Main sweep starts.



9

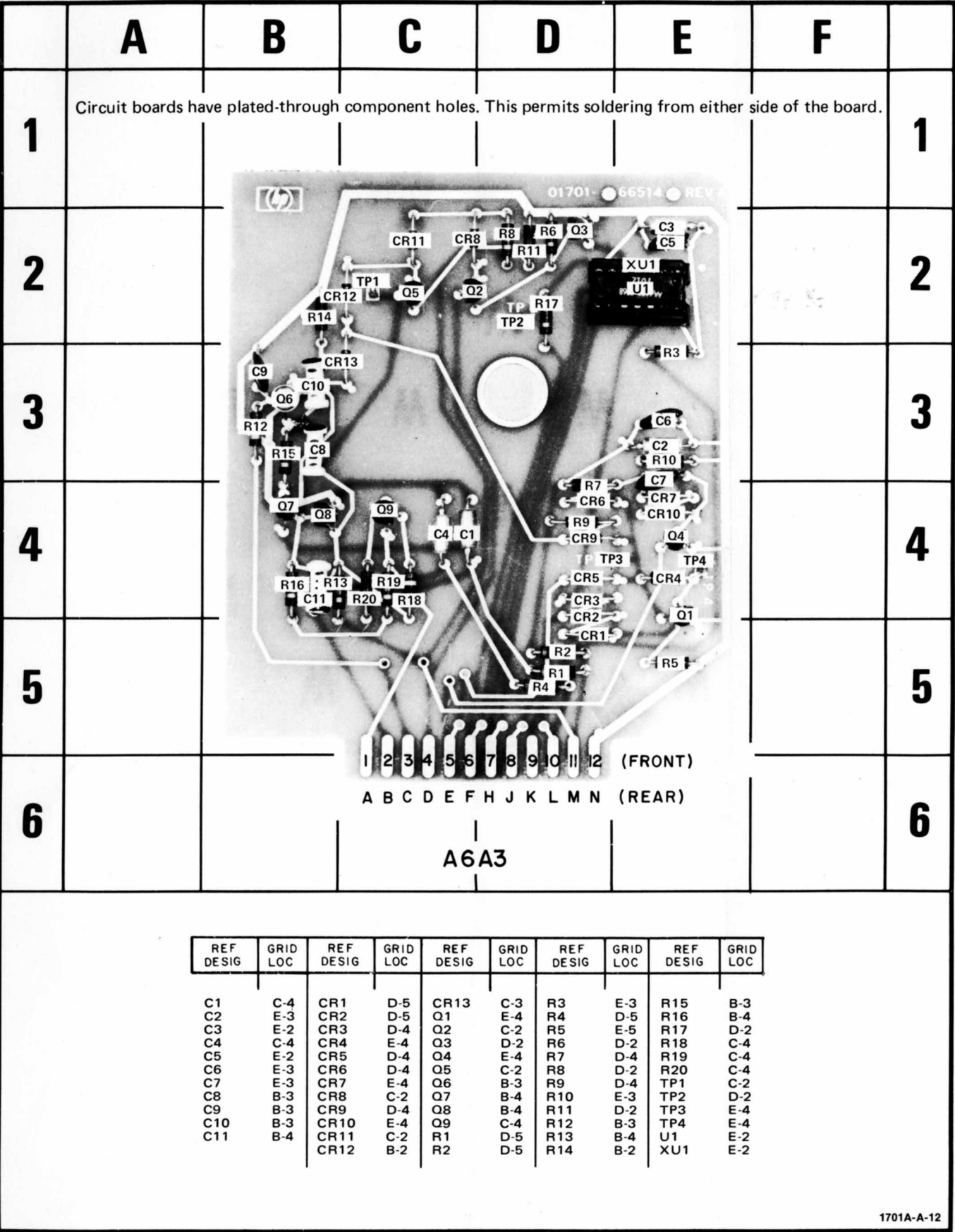
1707B-D-6A

Figure 8-20.
Trigger Assembly A6A2
8-41



REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	C-6	S1	C-6
C3	D-5	S2	C-6
Q1	A-4	S3	B-6
R1	A-4	S4	D-2
R2	A-4	S5	B-6
R3	B-6	XA3	B-4
R4	B-6	XA4	B-5
R6	B-6	XA5	B-3
R7	D-6	XA6	B-4
R8	B-3	XA7	B-2
R9	A-3	XA8	B-1
R10	B-4		
R11	B-6		

Figure 8-21. Horizontal Mother Board A6A1 Component Identification



1701A-A-12

Figure 8-22. Main Integrator A6A3 Component Identification

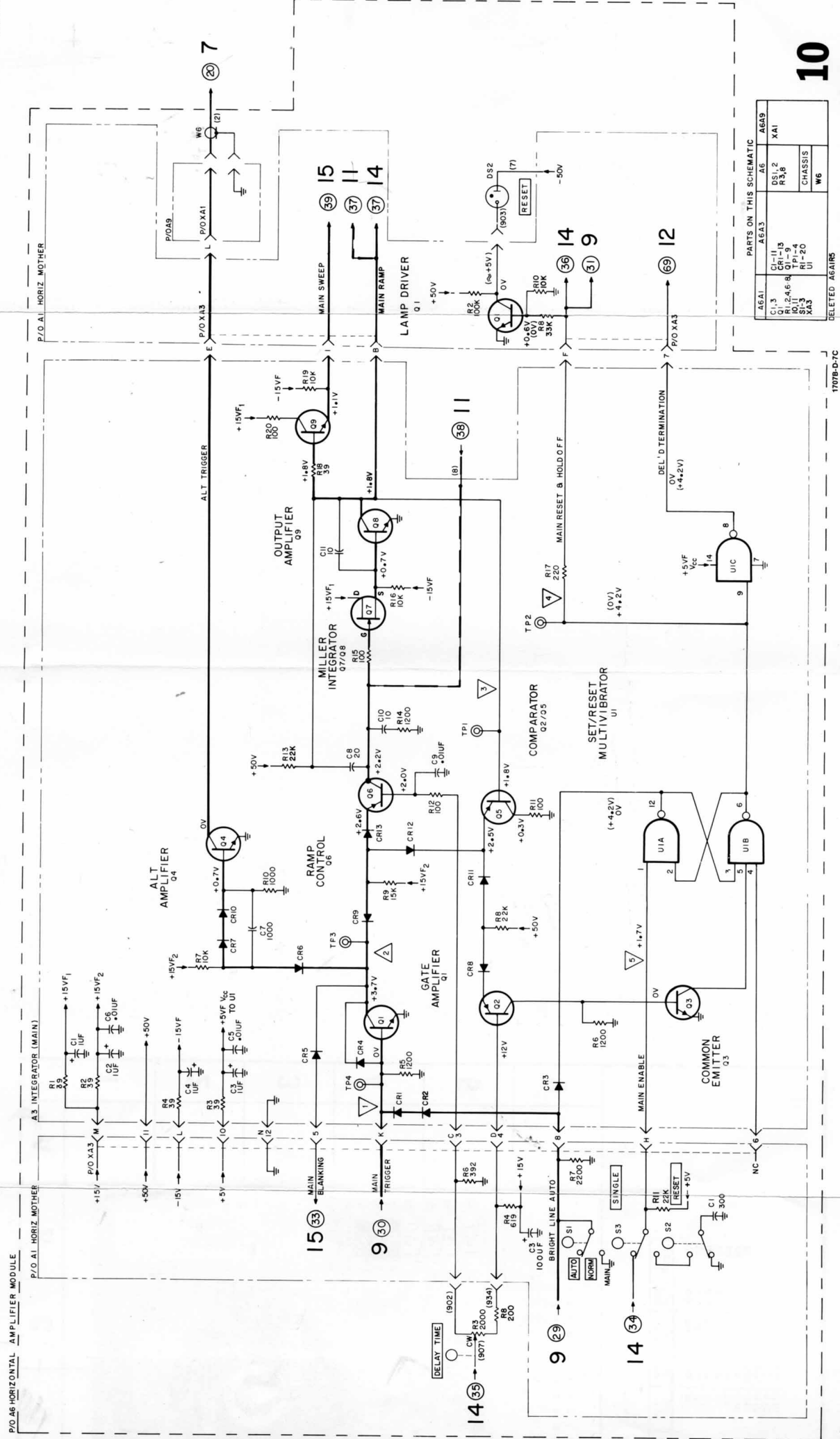


Figure 8-23.
Main Integrator A6A.3
8-43

Table 8-16. Schematic 10 Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set Model 1707B controls as follows:

AUTO/NORM..... AUTO
 SINGLE..... in
 X1/X10..... X1
 INT/EXT..... INT
 sweep display..... MAIN
 TRIGGER LEVEL (main and delayed) . cw

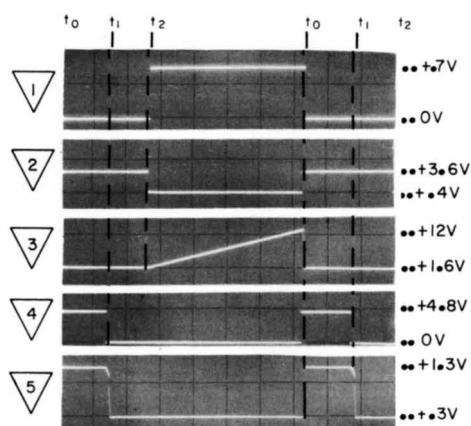
2. All voltages referenced to chassis ground.
 All indications nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

1. Set Model 1707B controls as follows:

AUTO/NORM..... AUTO
 X1/X10..... X1
 INT/EXT..... INT
 sweep display..... MAIN
 slope +/- +
 TIME/DIV 2 mSEC

2. Set monitor oscilloscope sweep time to 0.5 ms/div.
3. Set monitor oscilloscope vertical sensitivity to view coltage indicated at right of each waveform.
4. All waveforms referenced to chassis ground.



t_0 - Main sweep terminates.

t_1 - Main enable occurs.

t_2 - Main sweep starts.

Table 8-17. Schematic 11 Measurement Conditions

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:

AUTO/NORM AUTO
SINGLE in
X1/X10 X1
sweep display MAIN SWEEP
TRIGGER LEVEL (main and delayed) cw

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.



DC VOLTAGE MEASUREMENT CONDITIONS

2. All voltages referenced to chassis ground.
All indications nominal and may vary slightly.

```

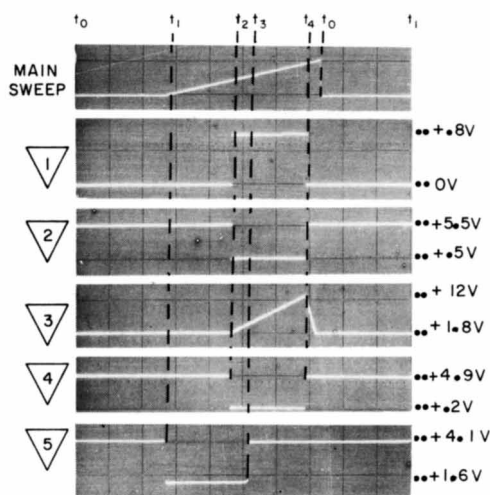
AUTO/NORM..... NORM
SINGLE..... in
X1/X10..... X1
INT/EXT..... INT
sweep display..... MAIN
TRIGGER LEVEL (main and delayed) . cw

```

1. Set Model 1707B controls as follows:

AUTO/NORM	AUTO
X1/X10	X1
INT/EXT	INT
sweep display	MAIN
slope +/-	+
TIME/DIV	.2 mSEC

2. Set monitor oscilloscope sweep speed to 0.5 ms/div.
3. Set monitor oscilloscope vertical sensitivity to view voltages indicated at right of each waveform.
4. All waveforms referenced to chassis ground.



t_0 - Main sweep terminates.

t_1 - Main sweep starts.

t_2 - Delayed sweep starts.

t₃ - Delayed enable occurs.

t₄ - Delayed sweep terminates.

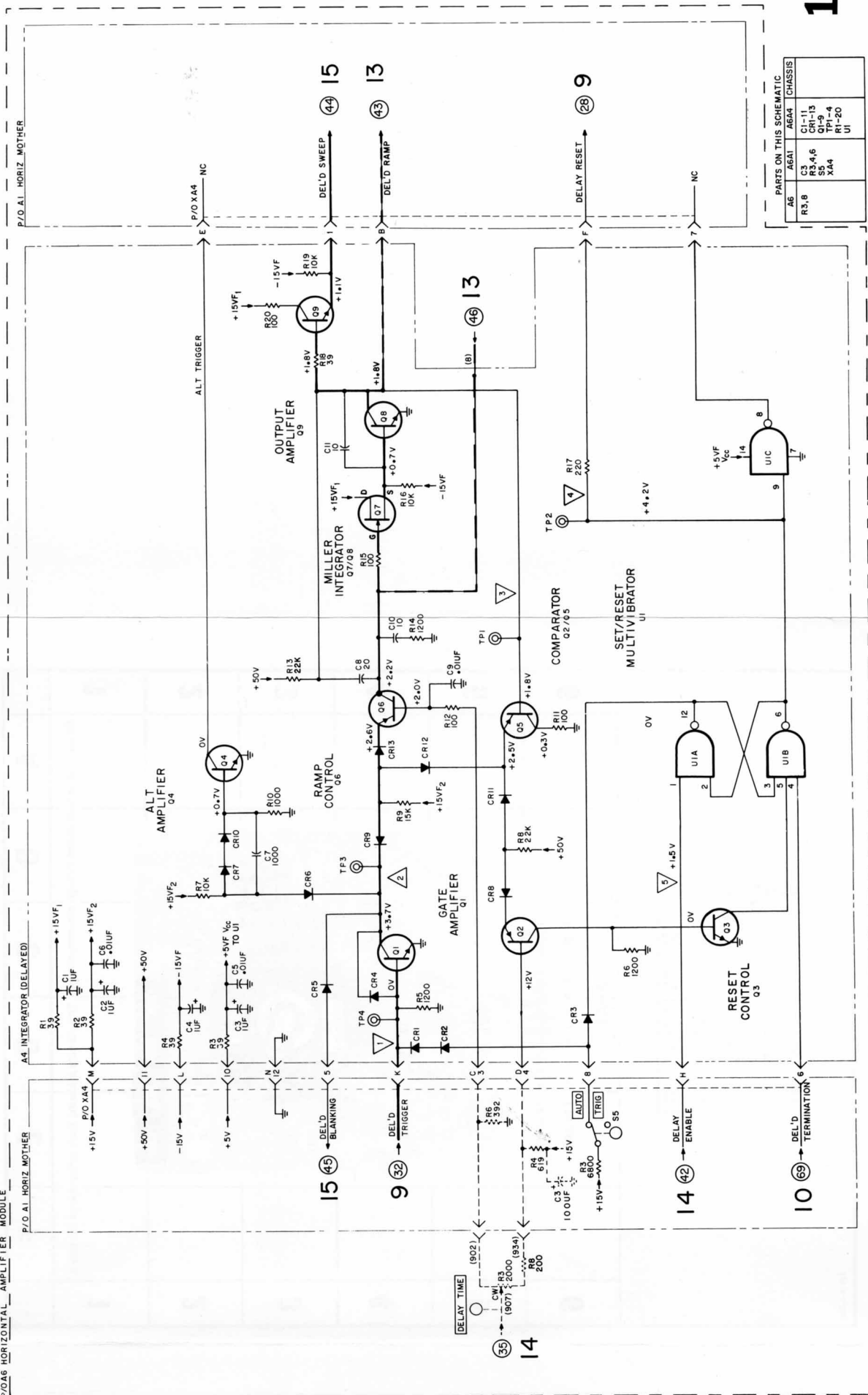
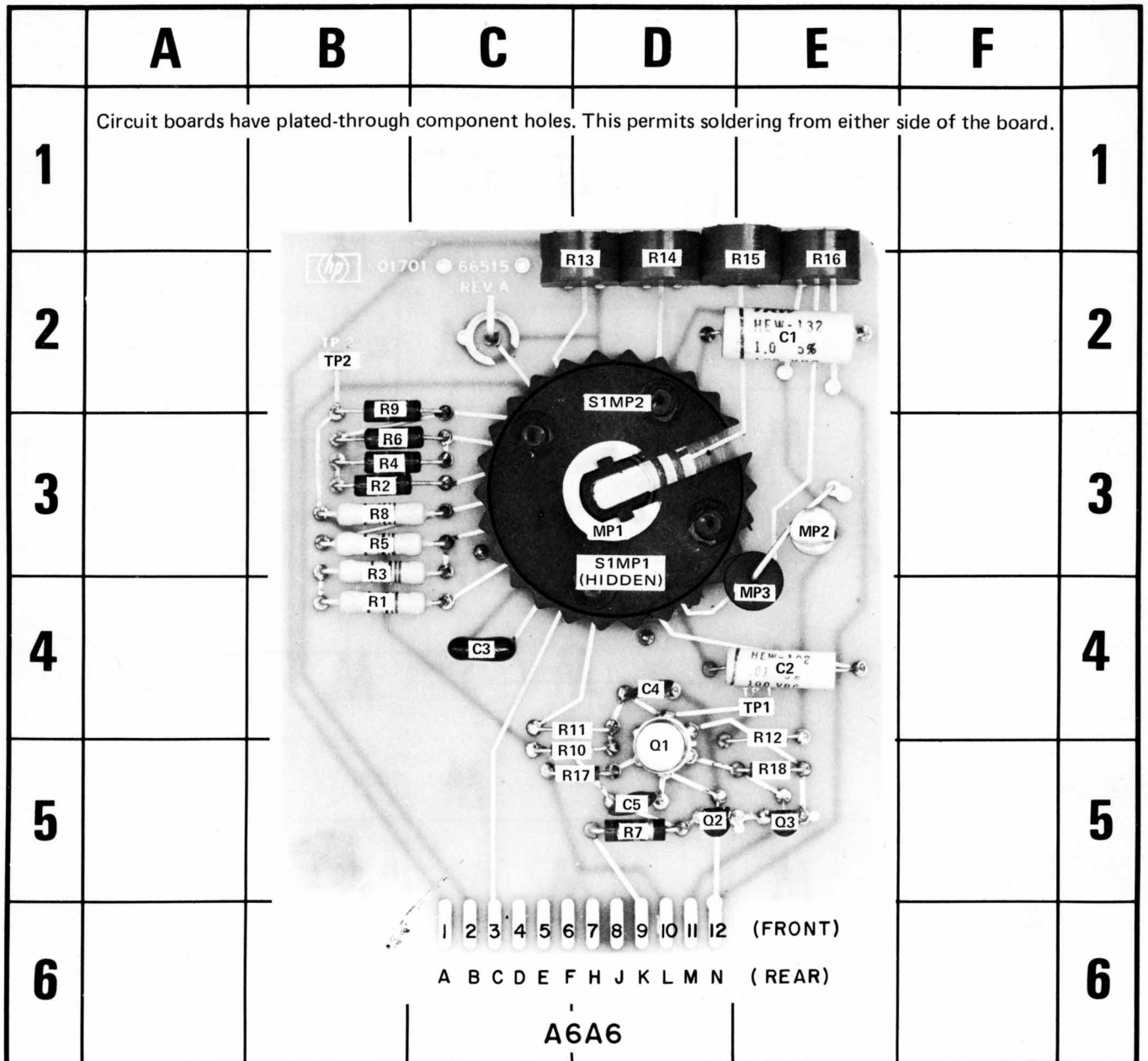


Figure 8-27.
Delayed Integrator A6A4
8-47



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	E-2	R1	B-4	R12	E-4
C2	E-4	R2	B-3	R13	D-2
C3	C-4	R3	B-3	R14	D-2
C4	D-4	R4	B-3	R15	E-2
C5	D-5	R5	B-3	R16	E-2
MP1	D-3	R6	B-3	R17	C-5
MP2	E-3	R7	D-5	R18	E-5
MP3	E-4	R8	B-3	S1MP1	D-3
Q1	D-5	R9	B-2	S1MP2	D-2
Q2	D-5	R10	C-5	TP1	E-4
Q3	E-5	R11	C-4	TP2	B-2

1701A-A-10A

Figure 8-28. Delayed Sweep Time Assembly A6A6 Component Identification

Table 8-19. Schematic 13 Measurement Conditions

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:

AUTO/NORM AUTO
SINGLE in
X1/X10 X1
sweep display MAIN SWEEP
TRIGGER LEVEL (main and delayed) cw

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

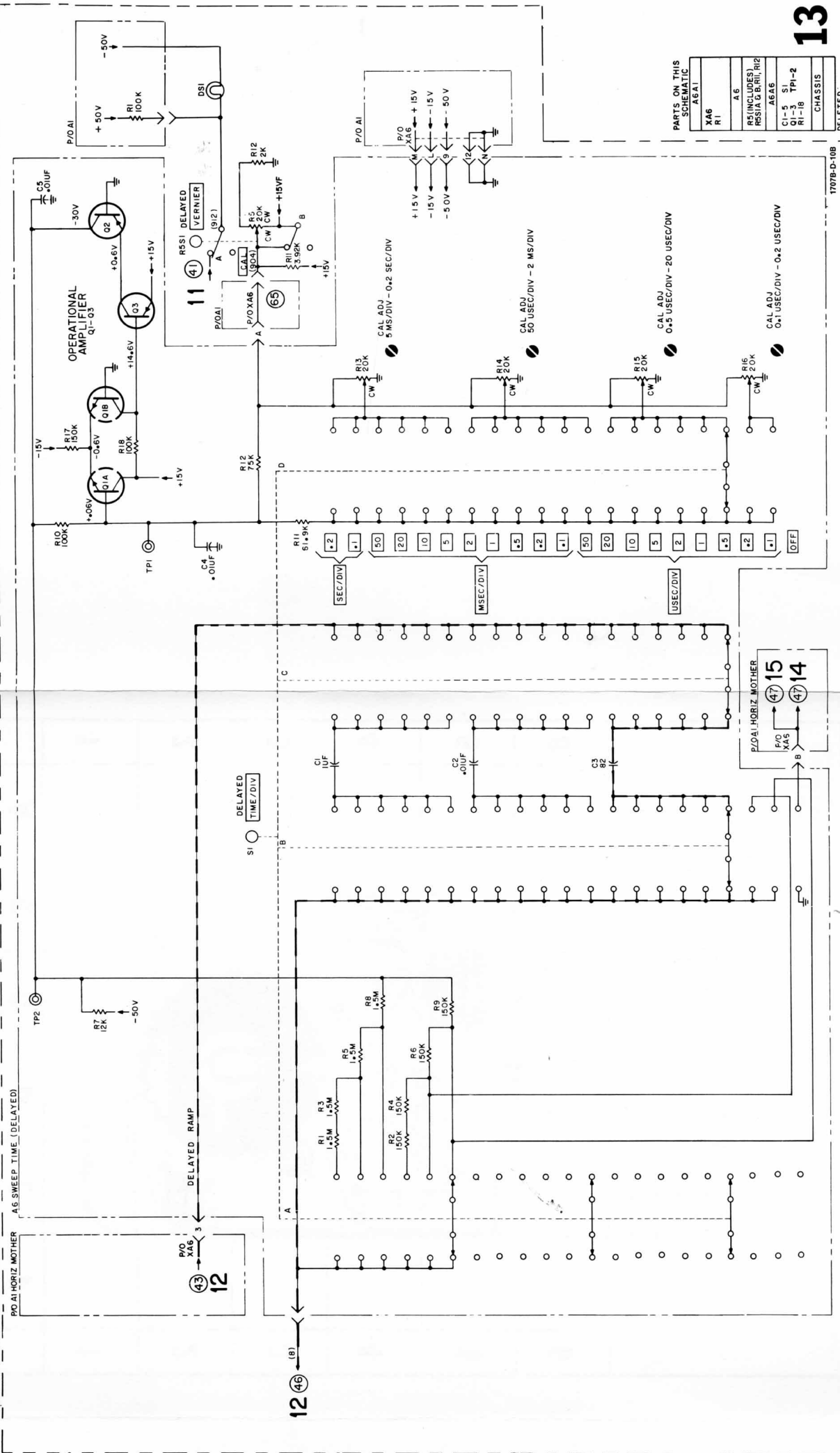


Figure 8-29
Delayed Sweep Time Assembly A6A6
8-49

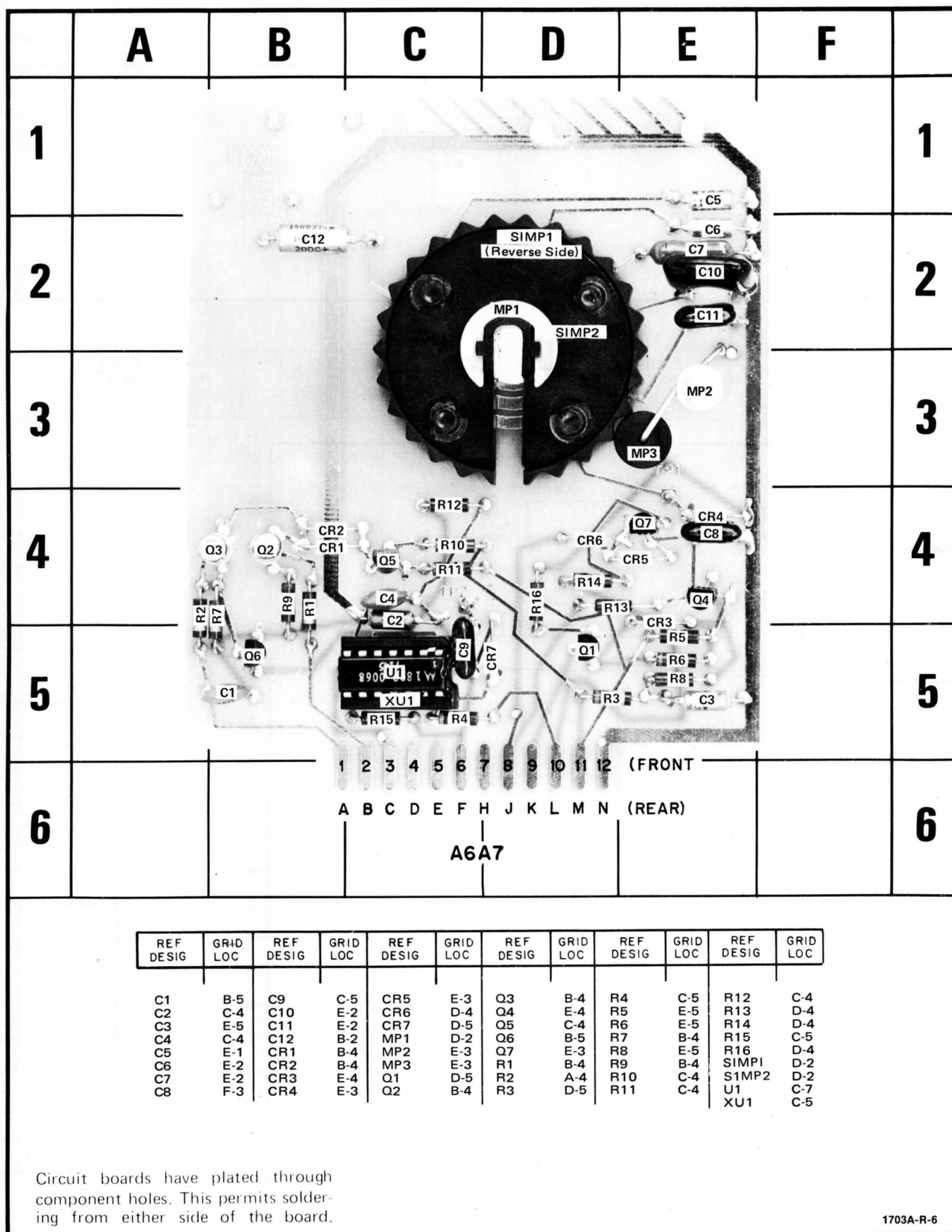


Figure 8-30. Holdoff and Comparator A6A7 Component Identification

Table 8-20. Schematic 14 Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:

AUTO/NORM AUTO
 SINGLE in
 sweep display MAIN SWEEP
 TRIGGER LEVEL (main and delayed) cw

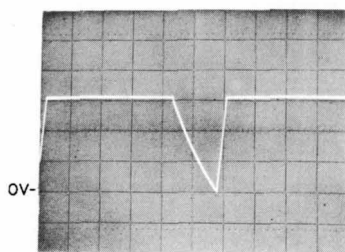
2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

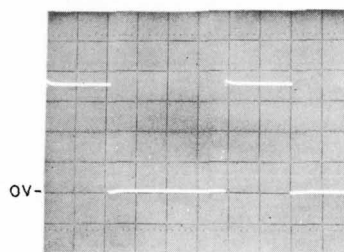
1. Set:

AUTO/NORM AUTO
 INT/EXT INT
 sweep display DELAYED SWEEP
 slope +/— +
 main TIME/DIV 2 mSEC
 delayed TIME/DIV 1 mSEC

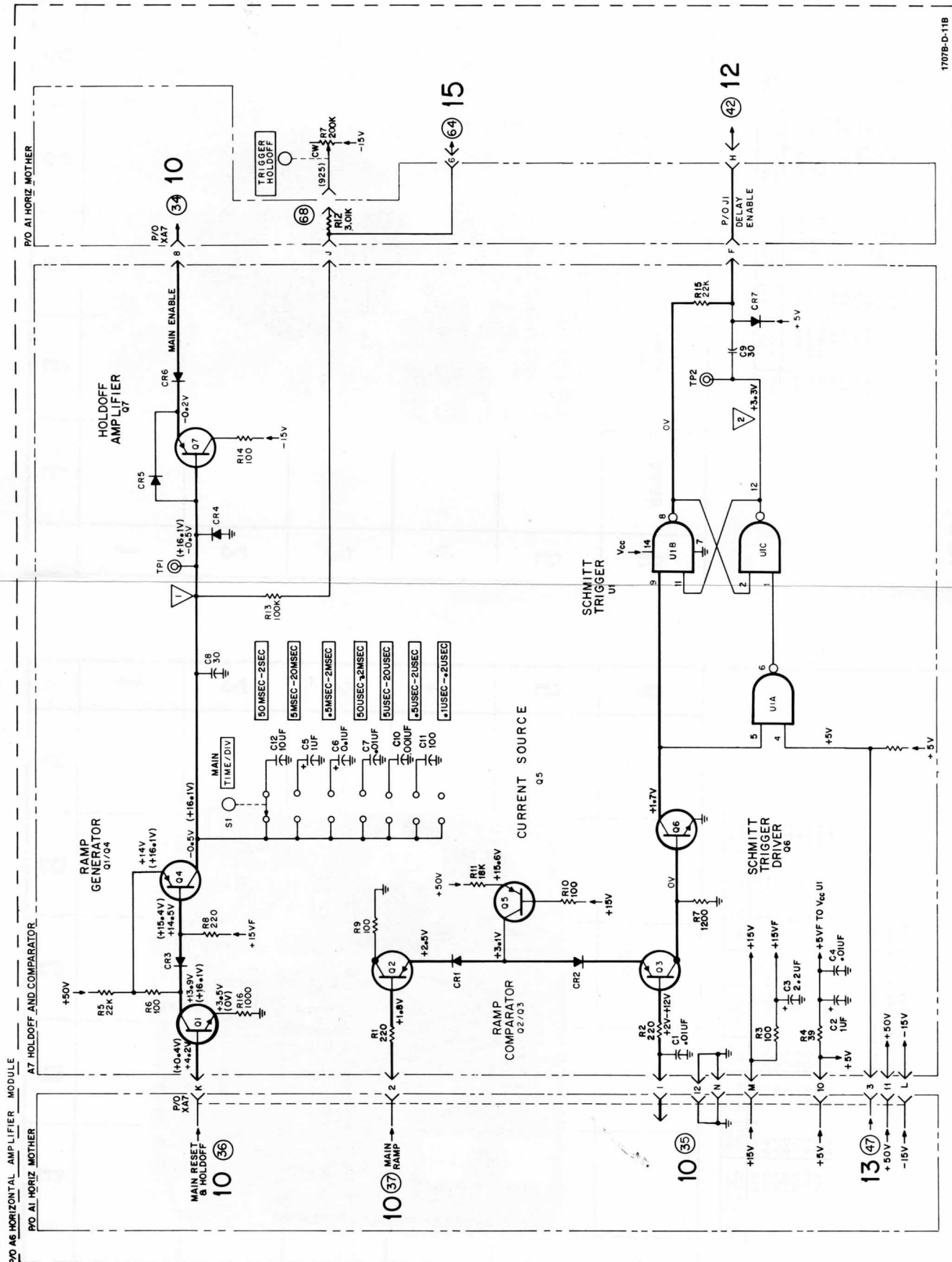
2. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.



1 5V/DIV
0.5MSEC/DIV



2 1V/DIV
0.5MSEC/DIV



PARTS ON THIS SCHEMATIC

A6A1	A6A7	A6
XA7	CR12	R7
R12	Q1-7	
	R1-16	
	TP1,2	
	UI	CHASSIS

DELETED: A6A1R5

Figure 8-31.
Holdoff and Comparator A6A7
8-51

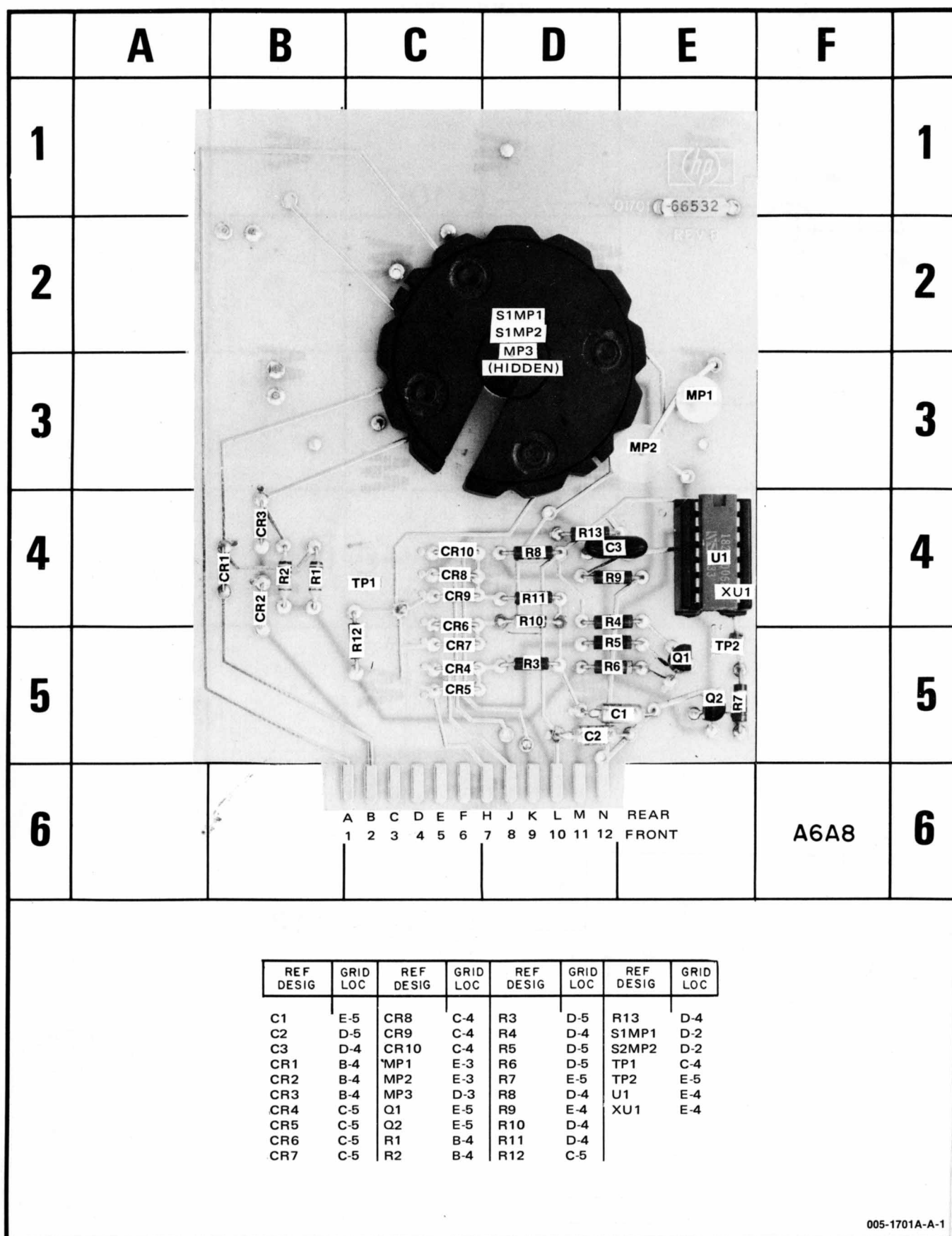
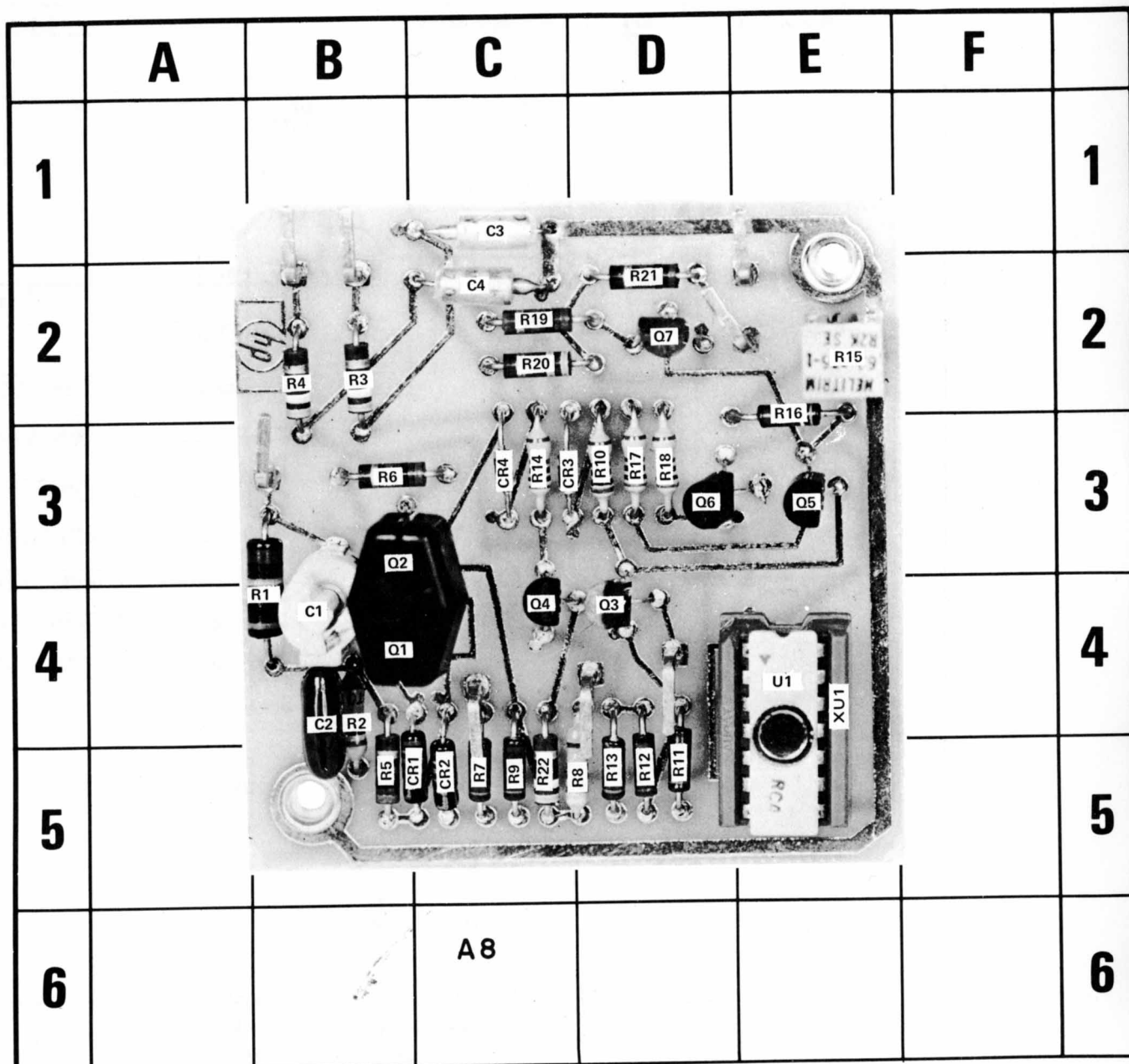


Figure 8-32. Horizontal Mode Assembly A6A8 Component Identification



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-4	Q1	B-4	R2	B-4	R10	D-3	R18	D-3
C2	B-4	Q2	B-3	R3	B-2	R11	D-5	R19	C-2
C3	C-1	Q3	D-4	R4	B-2	R12	D-5	R20	C-2
C4	C-2	Q4	C-4	R5	B-5	R13	D-5	R21	D-2
CR1	C-5	Q5	E-3	R6	B-3	R14	C-3	R22	C-5
CR2	C-5	Q6	D-3	R7	C-5	R15	E-2	U1	E-4
CR3	C-3	Q7	D-2	R8	D-5	R16	E-3	XU1	E-4
CR4	C-3	R1	B-4	R9	C-5	R17	D-3		

Circuit boards have plated through component holes. This permits soldering from either side of the board.

Figure 8-33. Ext Horizontal Amplifier Assembly A8, Component Identification

Table 8-21. Schematic 15 Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set Model 1707B controls as follows:

AUTO/NORM..... AUTO
 SINGLE..... in
 X1/X10..... X1
 INT/EXT..... INT
 sweep display..... MAIN
 TRIGGER LEVEL (main and delayed) . cw

2. All voltages referenced to chassis ground.
 All voltages nominal and may vary slightly.

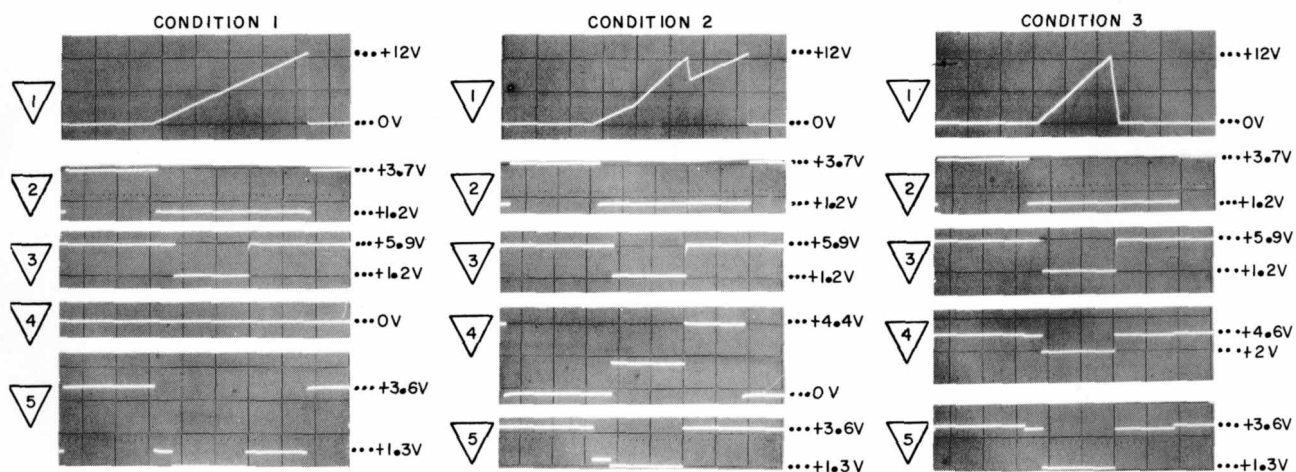
WAVEFORM MEASUREMENT CONDITIONS

1. Set Model 1707B controls as follows:

AUTO/NORM..... AUTO
 X1/X10..... X1
 INT/EXT..... INT
 slope +/- +
 TIME/DIV 2 mSEC
 sweep display:
 condition 1..... MAIN
 condition 2..... MIXED
 condition 3..... DELAYED

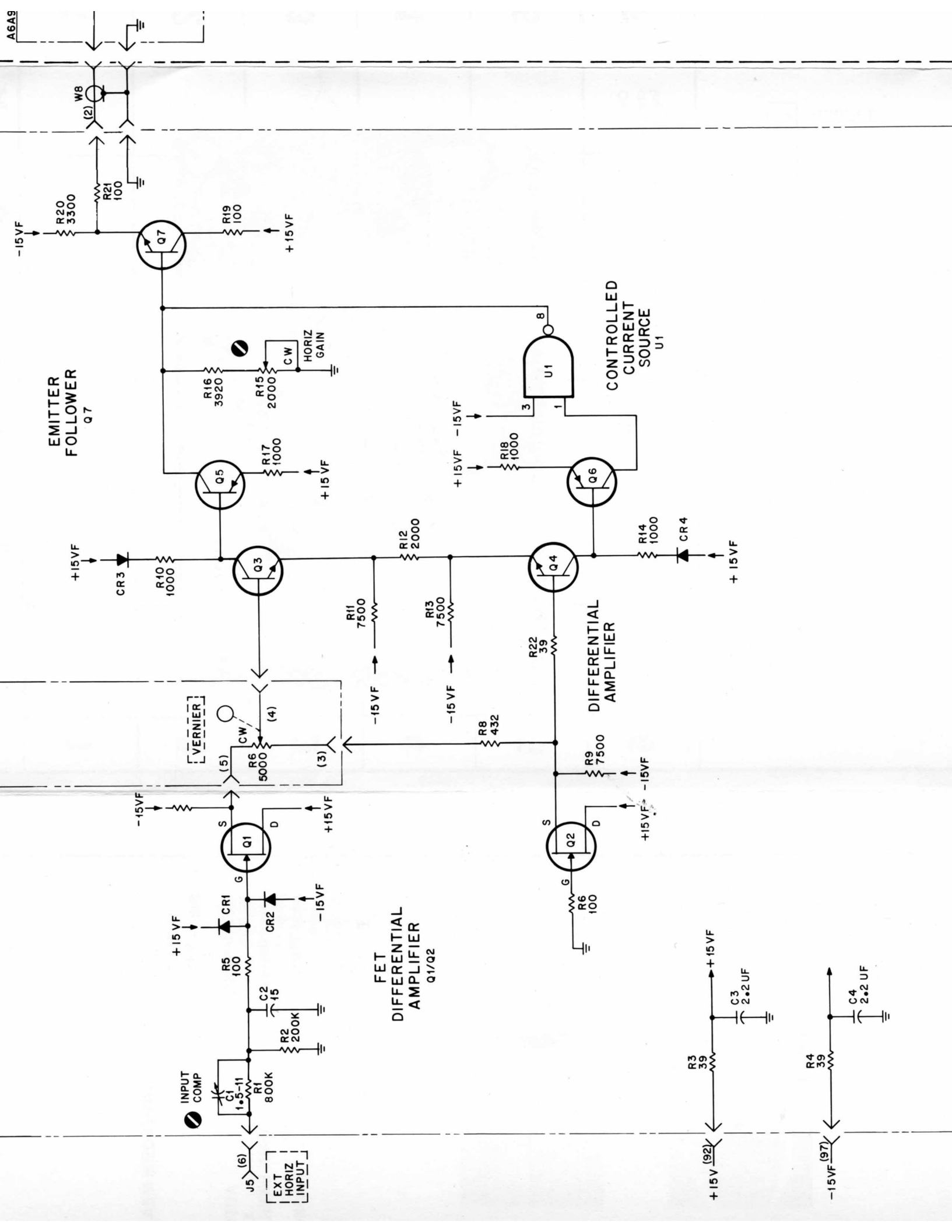
2. Set monitor oscilloscope sweep time to .5 ms/div.

3. Set monitor oscilloscope vertical sensitivity to view voltages indicated at right of each waveform.



1707B-B

1707B-B-1



A8 EXT HORIZ AMP

P/O A6 HORIZONTAL AMPLIFIER MODULE

P/OA1 HORIZ MOTHER SWEEP DI
14 64
-15V → P/
EXT HORIZ INPUT



10 39

12 44

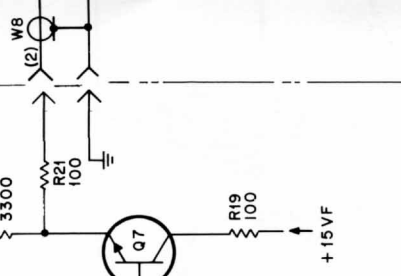
10 33

12 45

+15V

+5V

EMITTER FOLLOWER
Q7



Q7

+15V

CR3

R40

1000

Q3

Q5

R16

3920

R15

2000

CW

HORIZ GAIN

R17

1000

+15V

Q6

R18

1000

+15V

U1

CONTROLLED CURRENT SOURCE

Q4

R14

1000

CR4

+15V

R12

2000

R11

7500

-15V

R13

7500

-15V

R8

432

R9

7500

-15V

+15V

Q2

R6

100

Q1

R5

100

CR1

+15V

CR2

-15V

C2

15

R2

200K

R1

800K

C1

1.5-11

INPUT COMP

J5

EXT HORIZ INPUT

Q1/Q2

FET DIFFERENTIAL AMPLIFIER

Q4

R22

39

Q3

R16

3920

R15

2000

CW

HORIZ GAIN

R17

1000

+15V

Q6

R18

1000

+15V

U1

CONTROLLED CURRENT SOURCE

Q4

R14

1000

CR4

+15V

R12

2000

R11

7500

-15V

R13

7500

-15V

R8

432

R9

7500

-15V

+15V

Q2

R6

100

Q1

R5

100

CR1

+15V

CR2

-15V

C2

15

R2

200K

R1

800K

C1

1.5-11

INPUT COMP

J5

EXT HORIZ INPUT

Q1/Q2

FET DIFFERENTIAL AMPLIFIER

Q4

R22

39

Q3

R16

3920

R15

2000

CW

HORIZ GAIN

R17

1000

+15V

Q6

R18

1000

+15V

U1

CONTROLLED CURRENT SOURCE

Q4

R14

1000

CR4

+15V

R12

2000

R11

7500

-15V

R13

7500

-15V

R8

432

R9

7500

-15V

+15V

Q2

R6

100

Q1

R5

100

CR1

+15V

CR2

-15V

C2

15

R2

200K

R1

800K

C1

1.5-11

INPUT COMP

J5

EXT HORIZ INPUT

Q1/Q2

FET DIFFERENTIAL AMPLIFIER

Q4

R22

39

Q3

R16

3920

R15

2000

CW

HORIZ GAIN

R17

1000

+15V

Q6

R18

1000

+15V

U1

CONTROLLED CURRENT SOURCE

Q4

R14

1000

CR4

+15V

R12

2000

R11

7500

-15V

R13

7500

-15V

R8

432

R9

7500

-15V

+15V

Q2

R6

100

Q1

R5

100

CR1

+15V

CR2

-15V

C2

15

R2

200K

R1

800K

C1

1.5-11

INPUT COMP

J5

EXT HORIZ INPUT

Q1/Q2

FET DIFFERENTIAL AMPLIFIER

Q4

R22

39

Q3

R16

3920

R15

2000

CW

HORIZ GAIN

R17

1000

+15V

Q6

R18

1000

+15V

U1

CONTROLLED CURRENT SOURCE

Q4

R14

1000

CR4

+15V

R12

2000

R11

7500

-15V

R13

7500

-15V

R8

432

R9

7500

-15V

+15V

Q2

R6

100

Q1

R5

100

CR1

+15V

CR2

-15V

C2

15

R2

200K

R1

800K

C1

1.5-11

INPUT COMP

J5

EXT HORIZ INPUT

Q1/Q2

FET DIFFERENTIAL AMPLIFIER

Q4

R22

39

Q3

R16

3920

R15

2000

CW

HORIZ GAIN

R17

1000

+15V

Q6

R18

1000

+15V

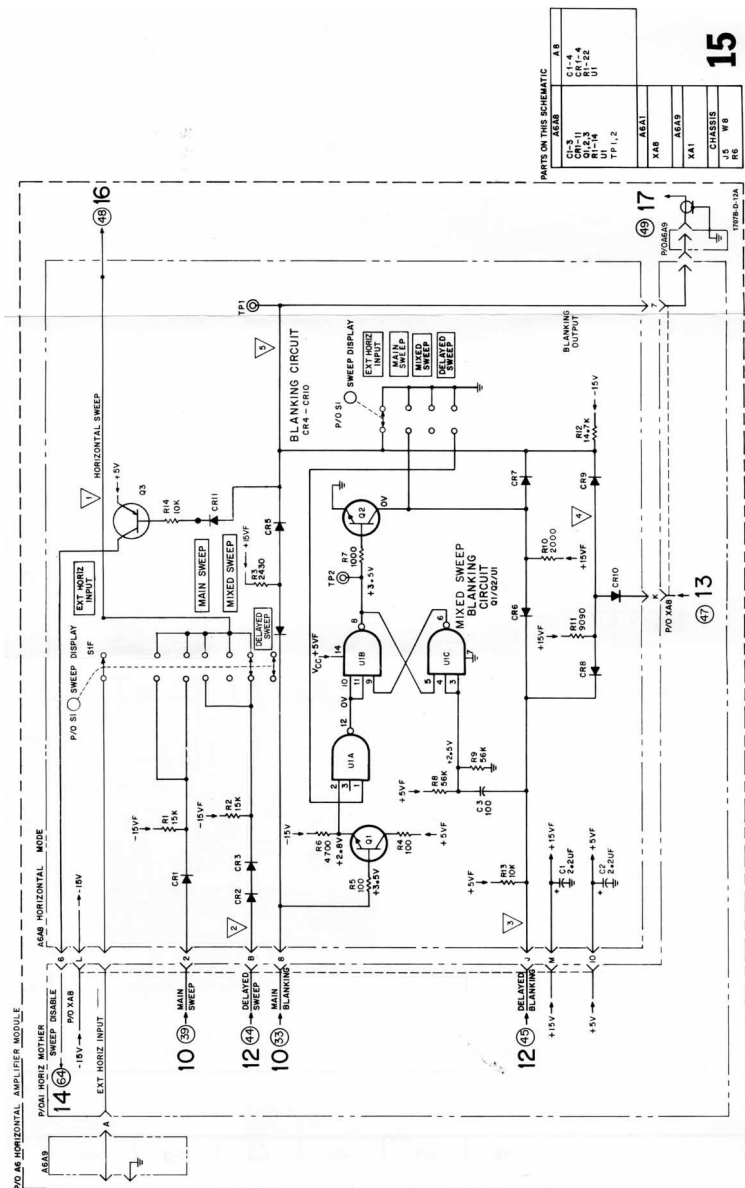
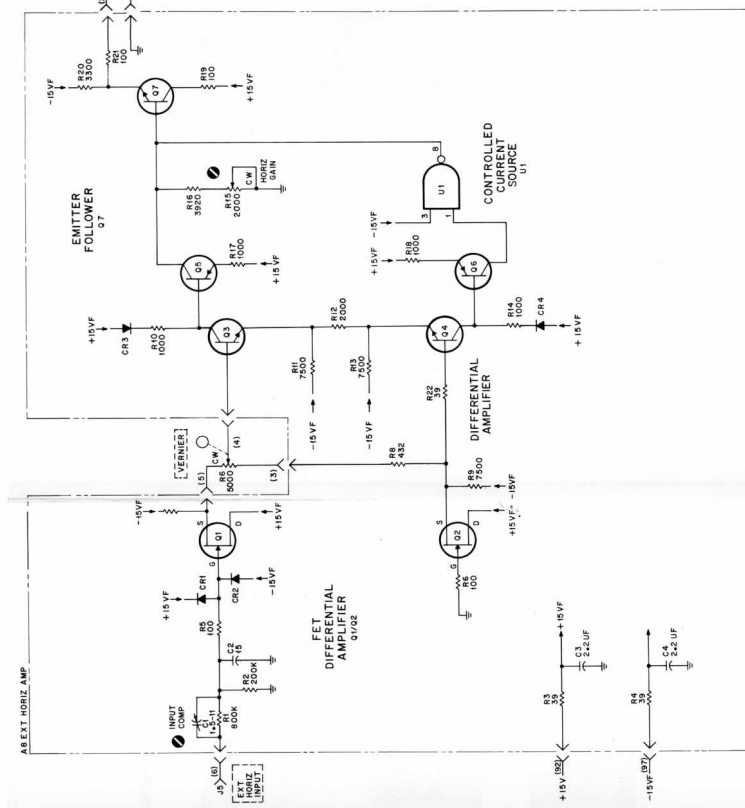
U1

CONTROLLED CURRENT SOURCE

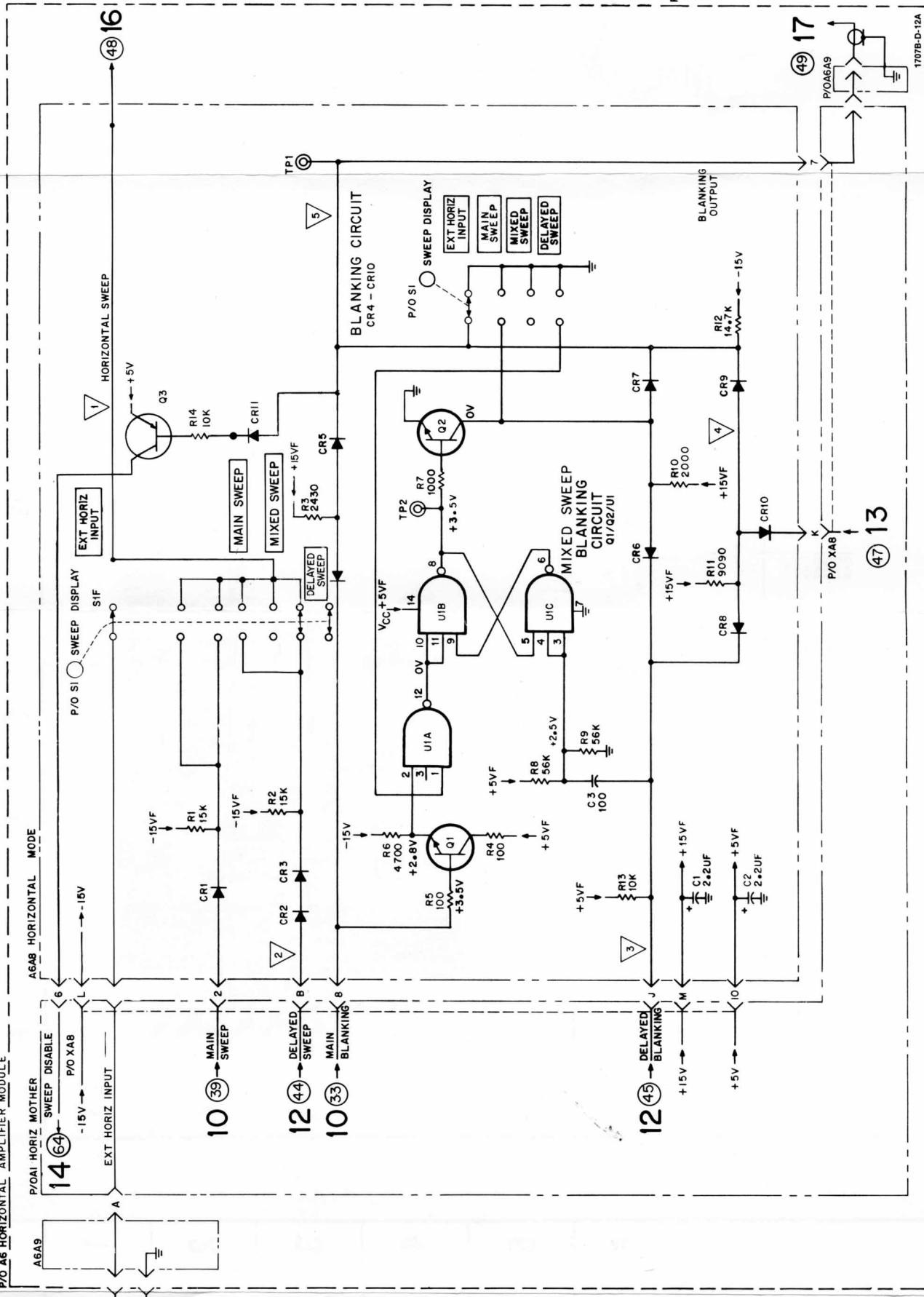
Q4

R14

1000



PARTS ON THIS SCHEMATIC	
ACA8	A 8
C1-3	C1-4
CN-11	CR-4
Q1,2,3	R1-22
U1-14	U1
TP1,2	
AGA1	
XAB	
AGA9	
XAI	
CHASSIS	
J5 W 8	
R6	



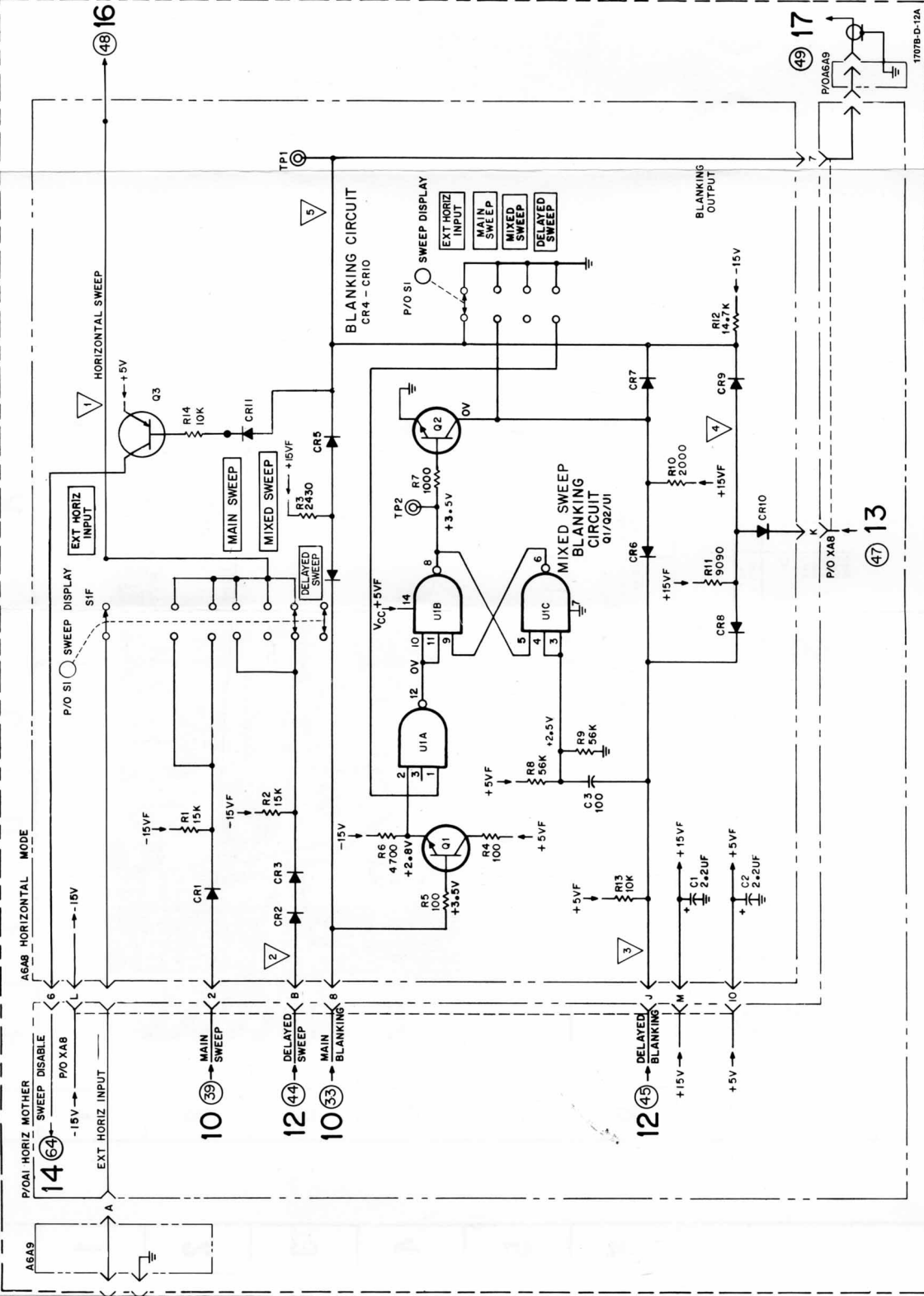
PARTS ON THIS SCHEMATIC

CL-3	A6A8	A8
CH-11		C1-4
CH-2,3		RA-124
RI-14		U1
U1		
TPI,2		
	A6A1	
XAB		
	A6A9	
XAI		
	CHASSIS	
	J5 W8	
	R6	

DELETED:

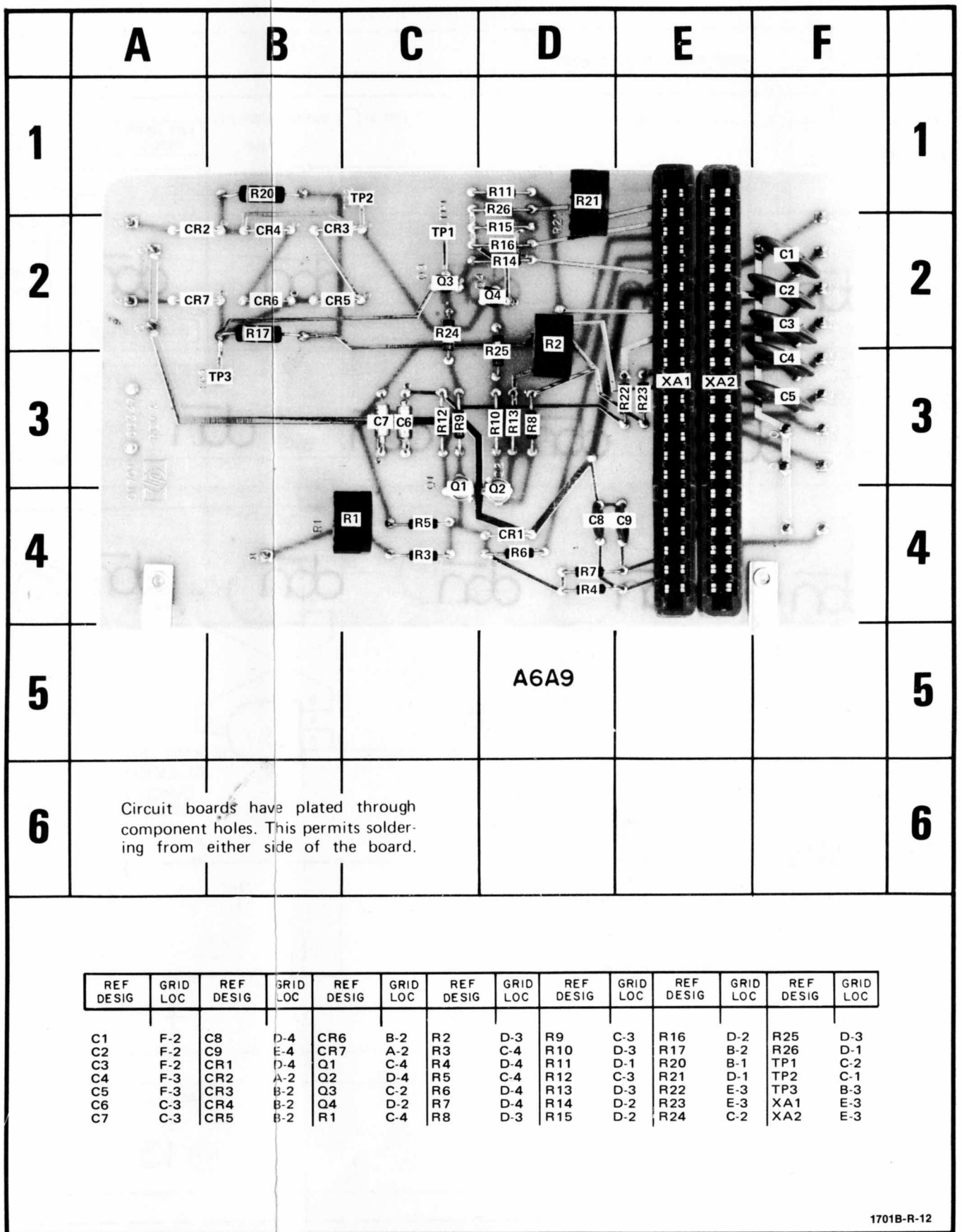
Figure 8-34.
Horizontal Mode Assembly A6A8
8-53

P/O A6 HORIZONTAL AMPLIFIER MODULE



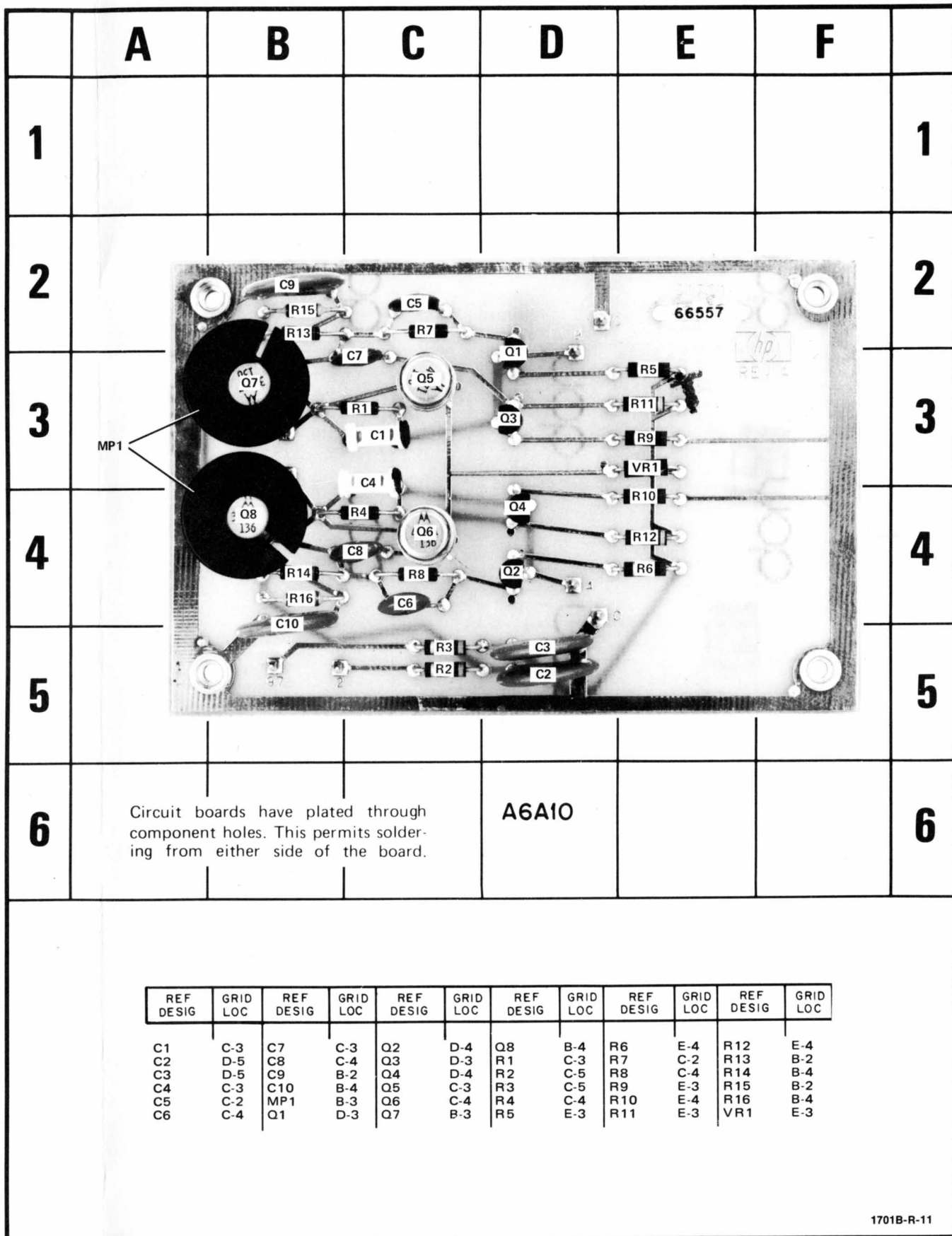
PARTS ON THIS SCHEMATIC

A6A8	A 8
CR-3	CR-4
CR-11	CR-14
Q1,2,3	R1-22
U1-14	U1
TPI, 2	
A6A1	
XA8	
A6A9	
XA1	
CHASSIS	
J5 W8	
R6	



1701B-R-12

Figure 8-35. Horizontal Preamplifier Assembly A6A9 Component Identification



1701B-R-11

Figure 8-36. Horizontal Output Amplifier Assembly A6A10 Component Identification

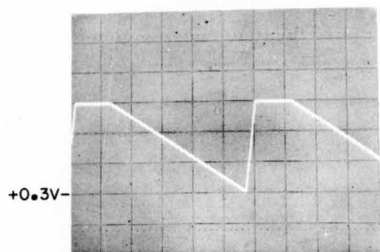
Table 8-22. Schematic 16 Measurement Conditions and Waveforms

WAVEFORM MEASUREMENT CONDITIONS

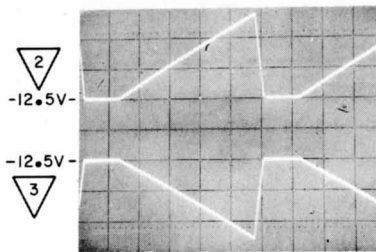
1. Set:

AUTO/NORM AUTO
 X1/X10 X1
 sweep display MAIN SWEEP
 slope +/— +
 main TIME/DIV 2 mSEC

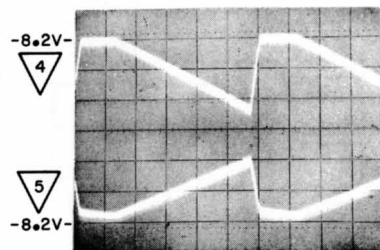
2. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.



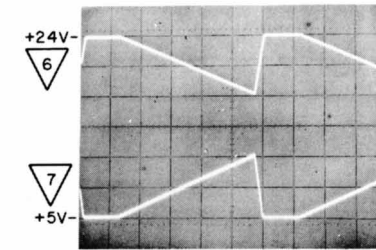
1 IV/DIV
 0.5MSEC/DIV



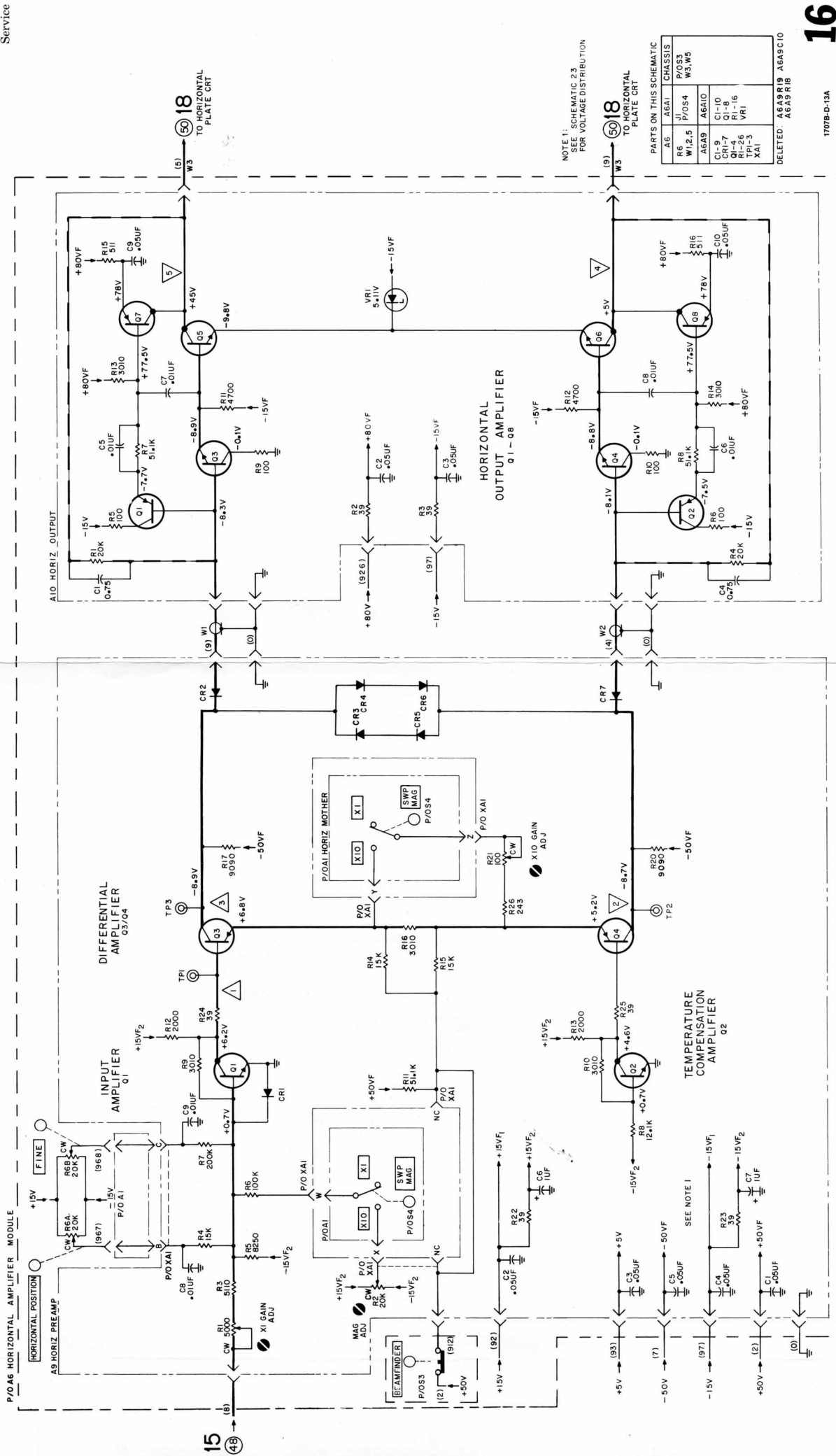
IV/DIV
 0.5MSEC/DIV



.005V/DIV
 0.5MSEC/DIV



10V/DIV
 0.5MSEC/DIV



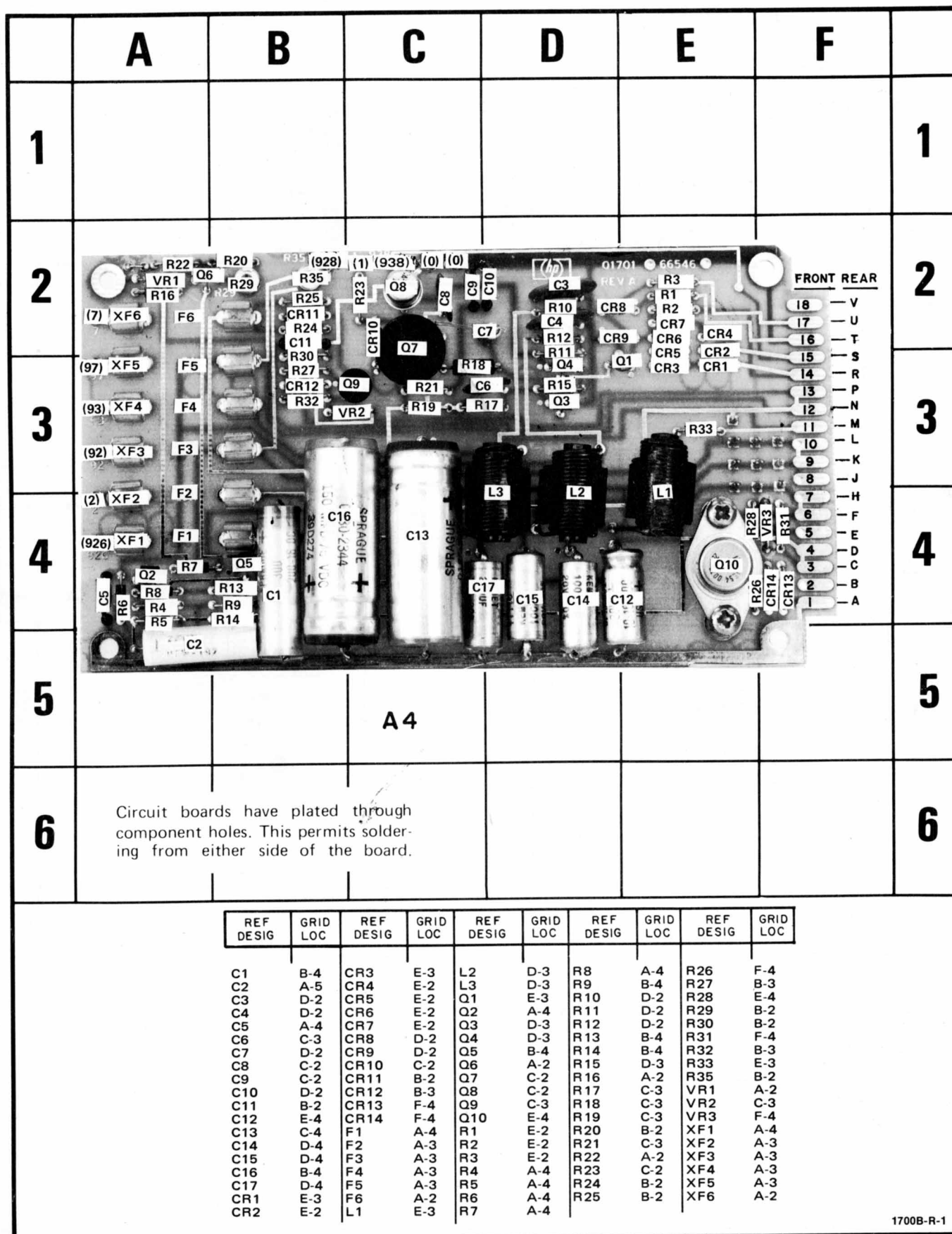


Figure 8-38. Gate Assembly A4 Component Identification

Table 8-23. Schematic 17 Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set Model 1707B controls as follows:

AUTO/NORM..... AUTO
 SINGLE..... in
 X1/X10..... X1
 INT/EXT..... INT
 sweep display..... MAIN
 TRIGGER LEVEL (main and delayed) . cw

2. All voltages referenced to chassis ground.
 All voltages nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

1. Set Model 1707B controls as follows:

AUTO/NORM..... AUTO
 X1/X10..... X1
 INT/EXT..... INT
 INTENSITY..... 10:00
 vertical coupling (A and B)..... GND

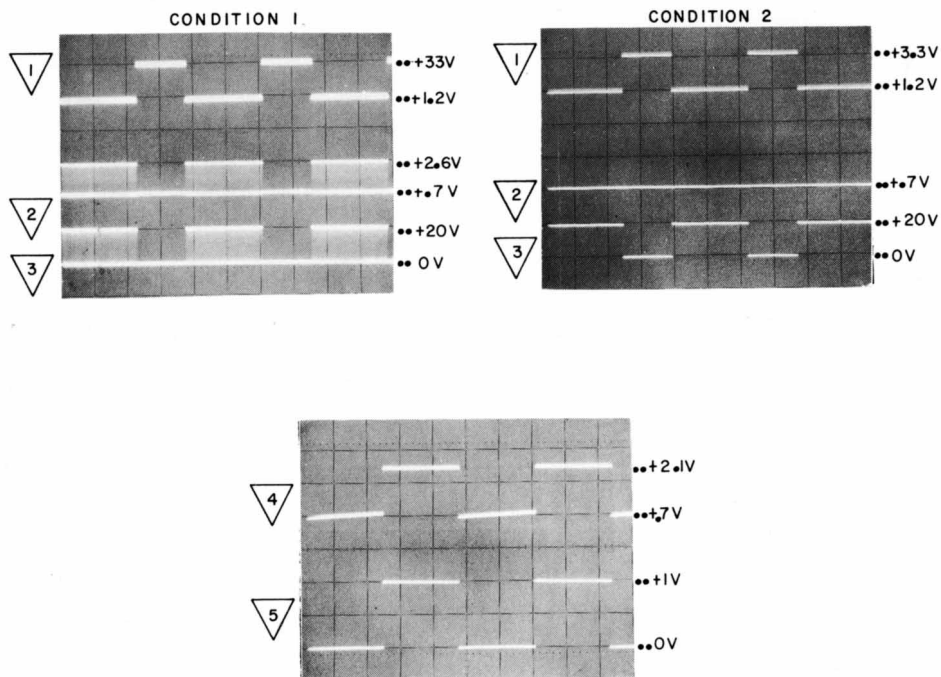
2. Set monitor oscilloscope sweep speed to 0.5 ms/div.

3. Set monitor oscilloscope vertical sensitivity to view voltages as indicated at right of each waveform.

4. All waveforms referenced to chassis ground.

DISPLAY:

condition 1..... CHOP
 condition 2..... ALT



1707B-A-15



Figure 8-39.
Gate Assembly A4

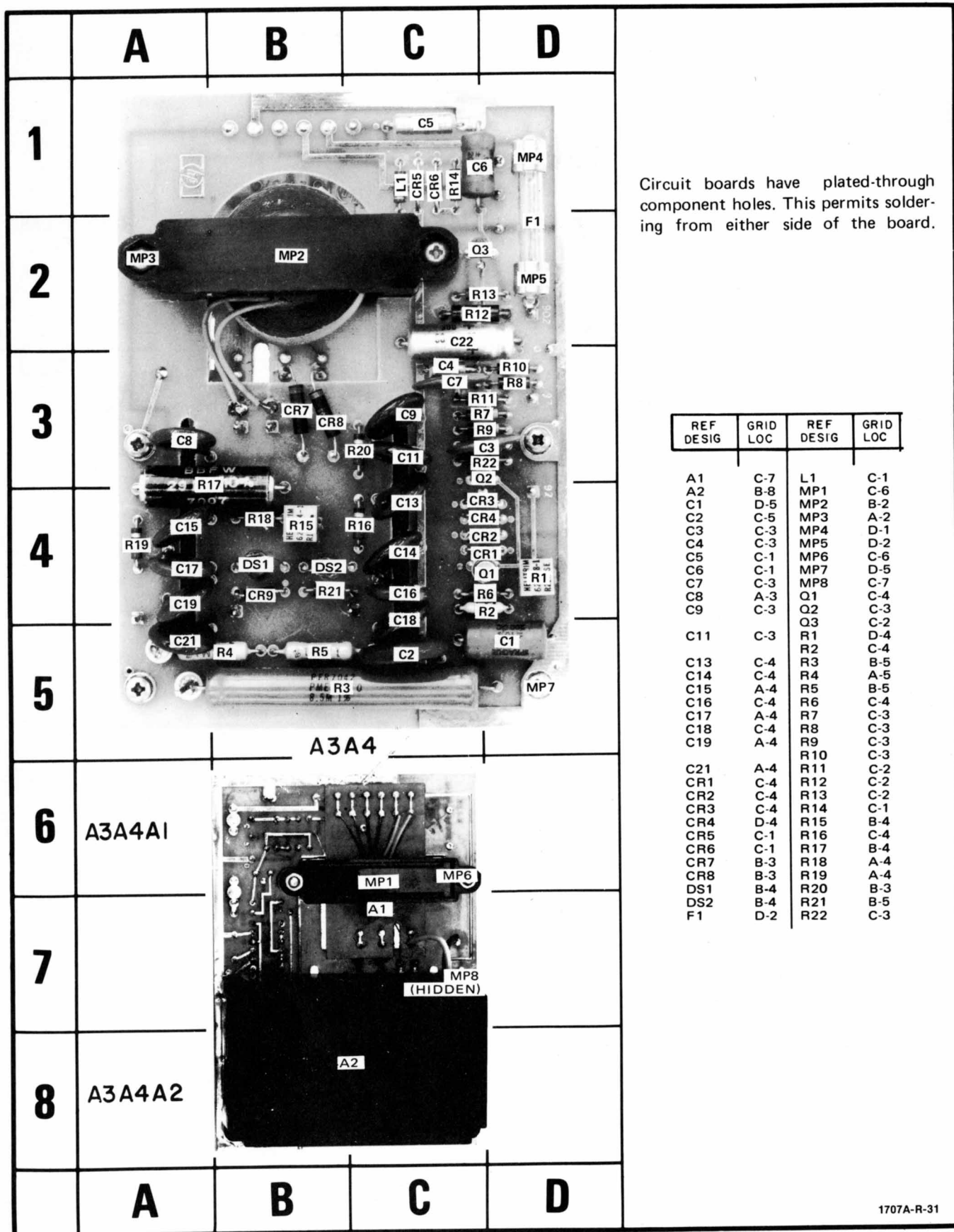


Figure 8-40. High Voltage Oscillator A3A4 Component Identification

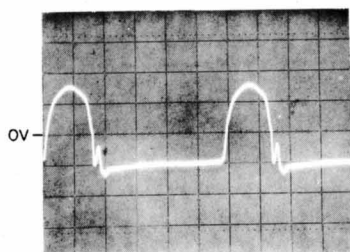
Table 8-24. Schematic 18 Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

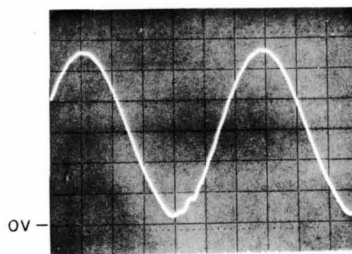
1. Set:
POWER on
INTENSITY CCW
2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

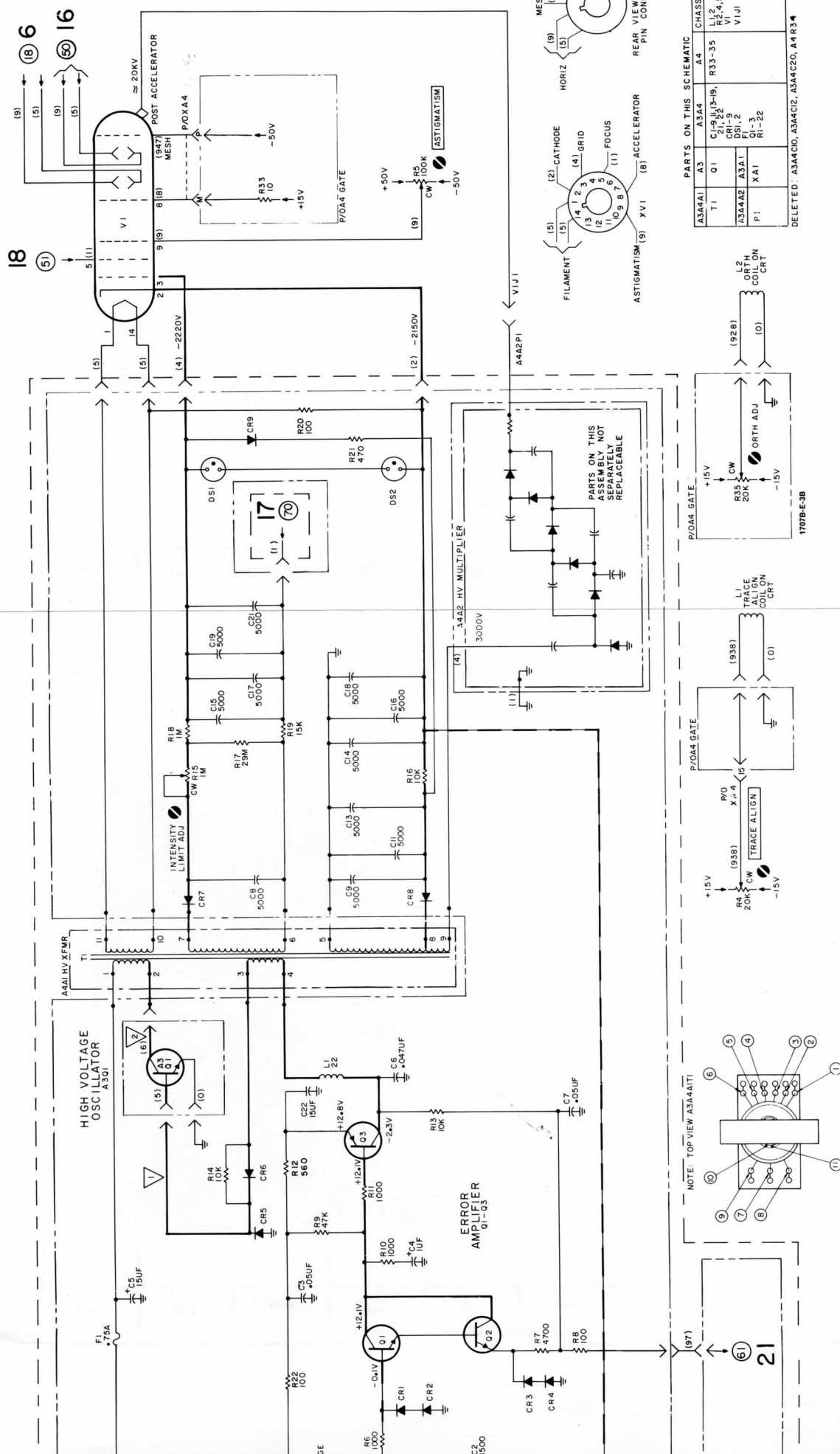
1. Set:
POWER on
INTENSITY CCW
2. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed setting are shown below each waveform photograph.



1 0.5V/DIV
5USEC/DIV



2 5V/DIV
5USEC/DIV



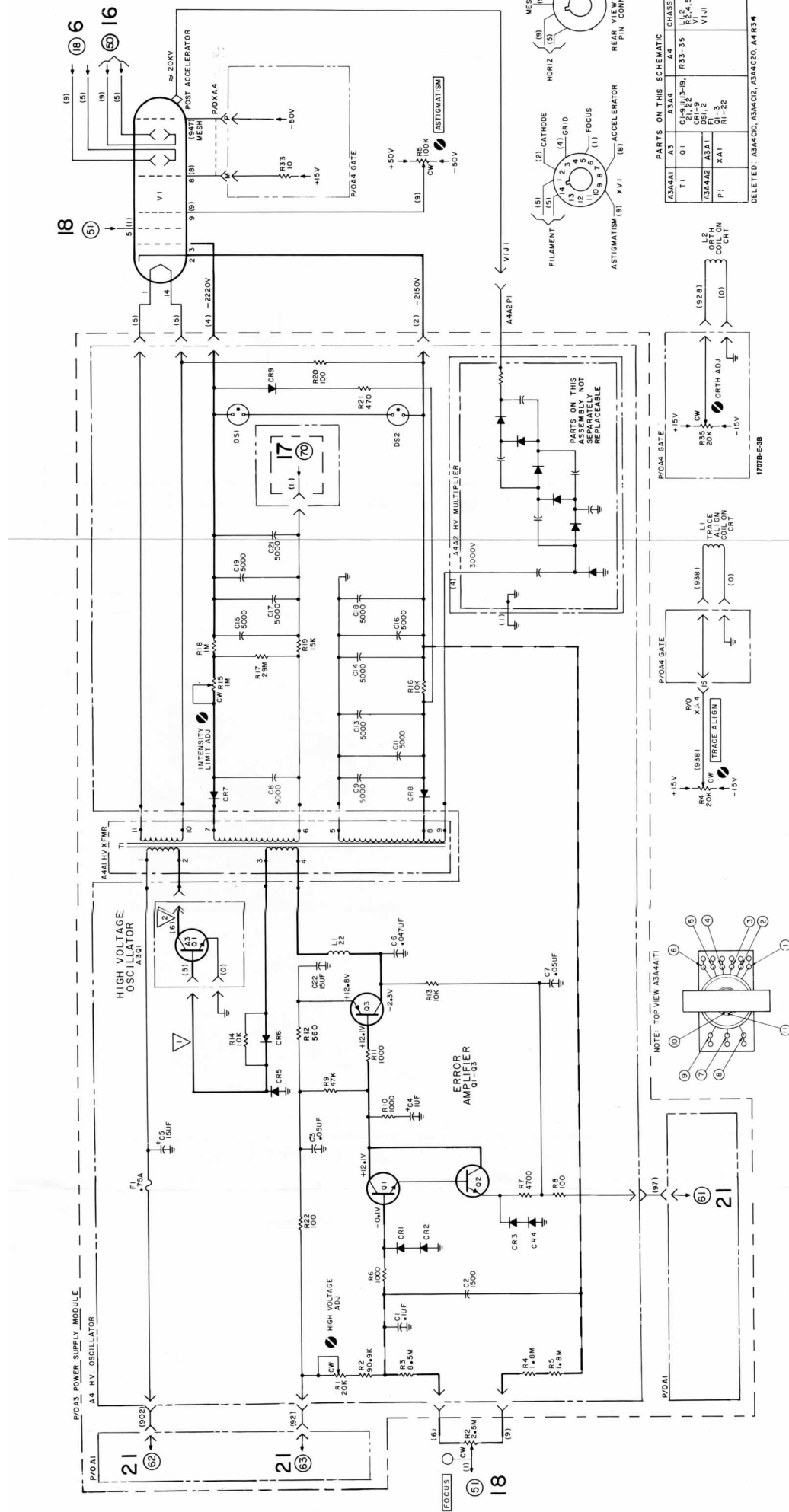


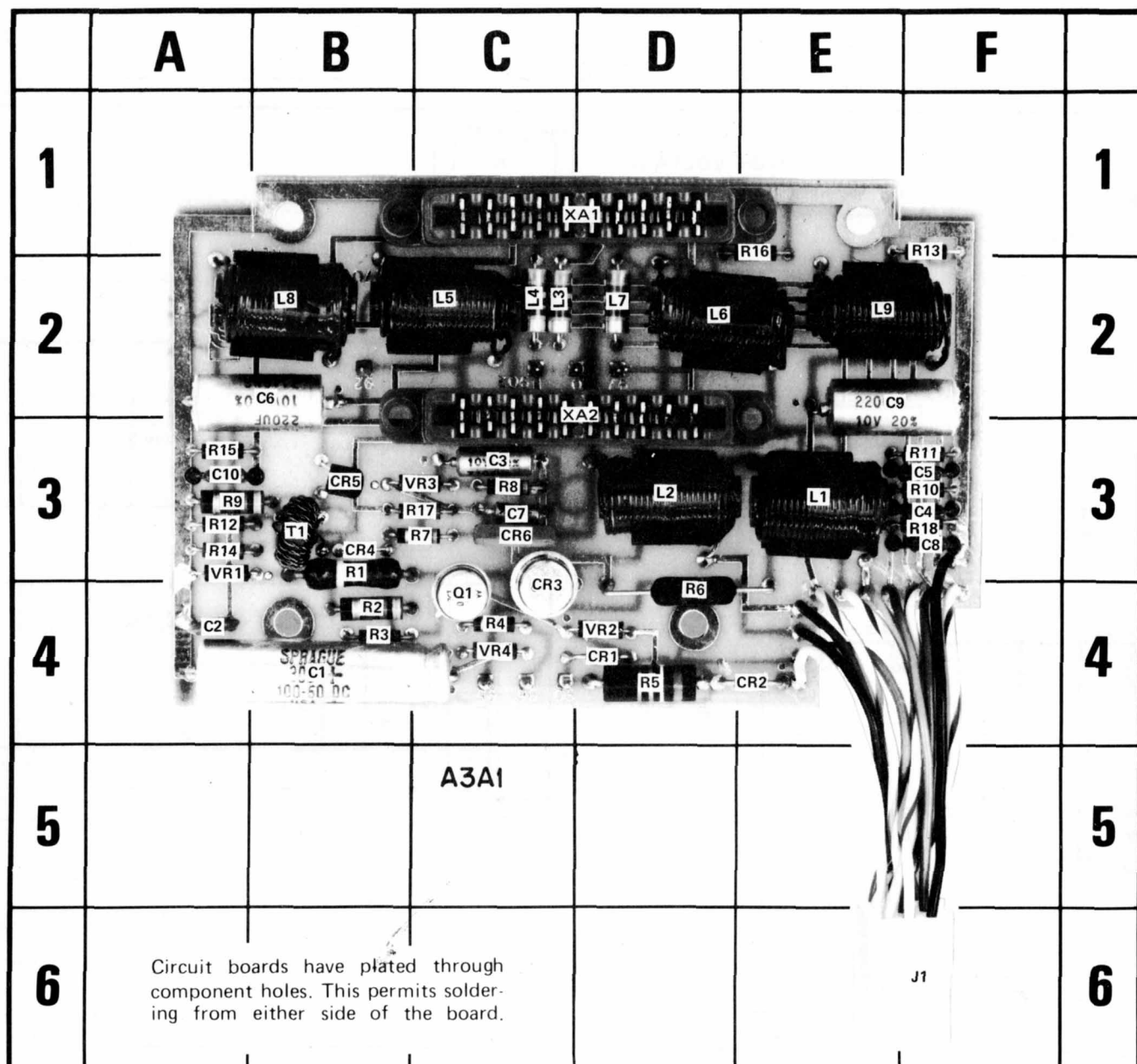
Figure 8-41
High Voltage Oscillator A3A4
8-59

Table 8-25. Schematic 19 Measurement Conditions

DC VOLTAGE MEASUREMENT CONDITION**1. Set:**

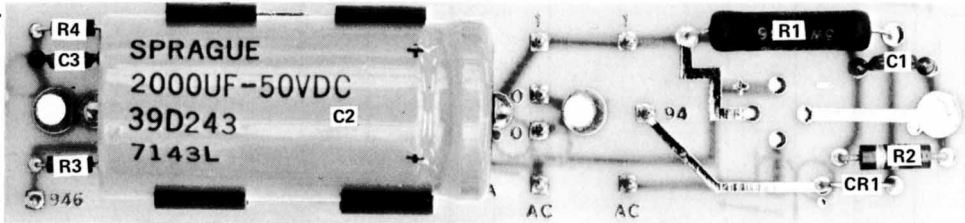
POWER MODE AC Line (115V ac)
POWER on

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.



REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	B-4	C10	A-3	L2	D-3	R1	B-3	R10	F-3	T1	B-3
C2	A-4	CR1	D-4	L3	C-2	R2	B-4	R11	F-3	VR1	A-3
C3	C-3	CR2	E-4	L4	C-2	R3	B-4	R12	A-3	VR2	D-4
C4	F-3	CR3	C-4	L5	C-2	R4	C-4	R13	F-1	VR3	C-3
C5	F-3	CR4	B-3	L6	D-2	R5	D-4	R14	A-3	VR4	C-4
C6	B-2	CR5	B-3	L7	D-2	R6	D-4	R15	A-3	XA1	D-1
C7	C-3	CR6	C-3	L8	B-2	R7	C-3	R16	E-1	XA2	D-2
C8	F-3	J1	F-6	L9	E-2	R8	C-3	R17	C-3		
C9	F-2	L1	E-3	Q1	C-4	R9	A-3	R18	F-3		

Figure 8-43. Low Voltage Mother Board A3A1 Component Identification

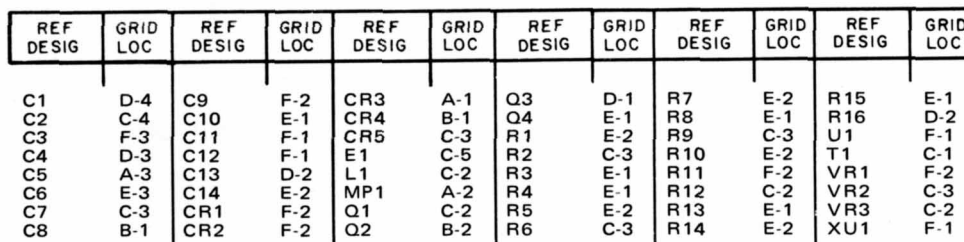
	A	B	C	D	E	F	
1							1
2							2
3							3
4				A2			4
5							5
6							6

REF DESIG	GRID LOC	REF DESIG	GRID LOC
C1	F-3	R1	E-3
C2	C-3	R2	F-3
C3	A-3	R3	A-3
CR1	E-3	R4	A-3

Circuit boards have plated through component holes. This permits soldering from either side of the board.

1703A-R-9

Figure 8-42. Line Rectifier A2 Component Identification



1703A-R-7

Figure 8-45. Low Voltage Converter Assembly A3A2 Component Identification

Table 8-26. Schematic 20 Measurement Conditions and Waveforms

DC VOLTAGE MEASUREMENT CONDITIONS

1. Set:
POWER switch on

2. All voltages are referenced to chassis ground. All indications are nominal and may vary slightly.

WAVEFORM MEASUREMENT CONDITIONS

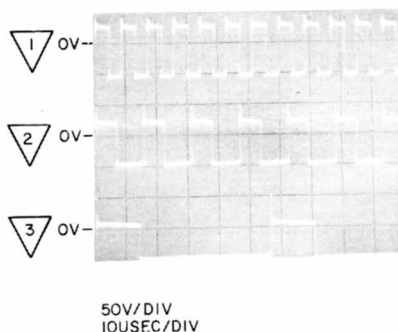
1. Set:
POWER switch on
POWER MODE switch DC LINE

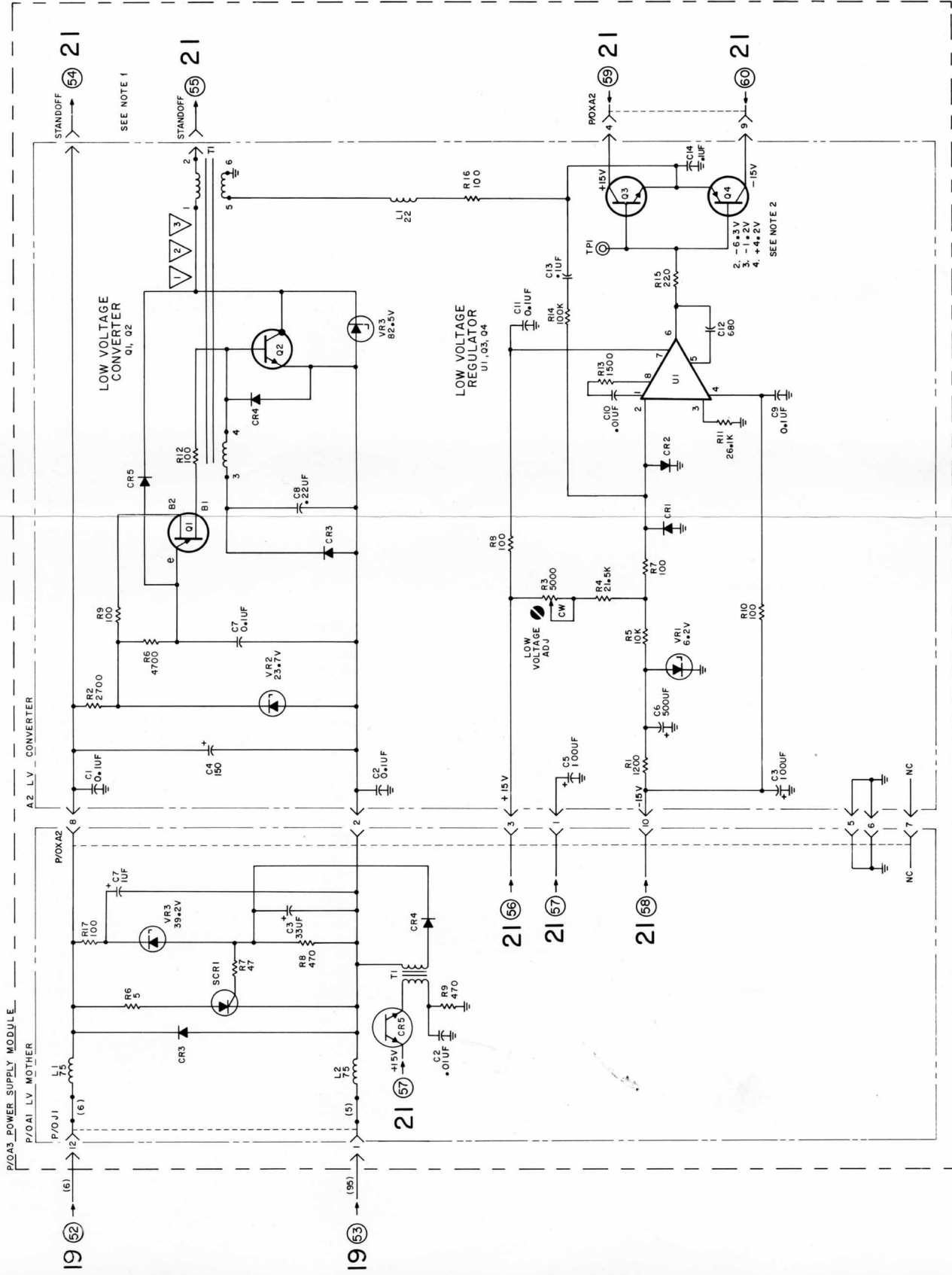
5. All waveforms are referenced to chassis ground. The monitor oscilloscope's vertical sensitivity (using a 1:1 probe) and sweep speed settings are shown below each waveform photograph.

2. Connect:
EXT DC INPUT 36 VDC
observe 

3. Connect:
EXT DC INPUT 24 VDC
observe 

4. Connect:
EXT DC INPUT 11.5 VDC
observe 





NOTE:
1. THE STANDOFFS ARE METAL CONDUCTORS PROVIDING ELECTRICAL CONNECTION BETWEEN THE A3A2 AND A3A3 ASSEMBLIES.
2. SEE VOLTAGE MEASUREMENT CONDITIONS

PARTS ON THIS SCHEMATIC

A3A1	A3A2
C2, 3, 7	CI-14
CR3, 4, 5	CR1-5
LI	LI
LI-2	LI-4
LI-3, 17	LI-16
SCR1	TI-1
TI	TI
VR3	VR1-3
XA2	TPI
CHASSIS	

DELETED:

1107B-D-16A

20

Figure 8-46.
Low Voltage Converter Assembly A3A2
8-63

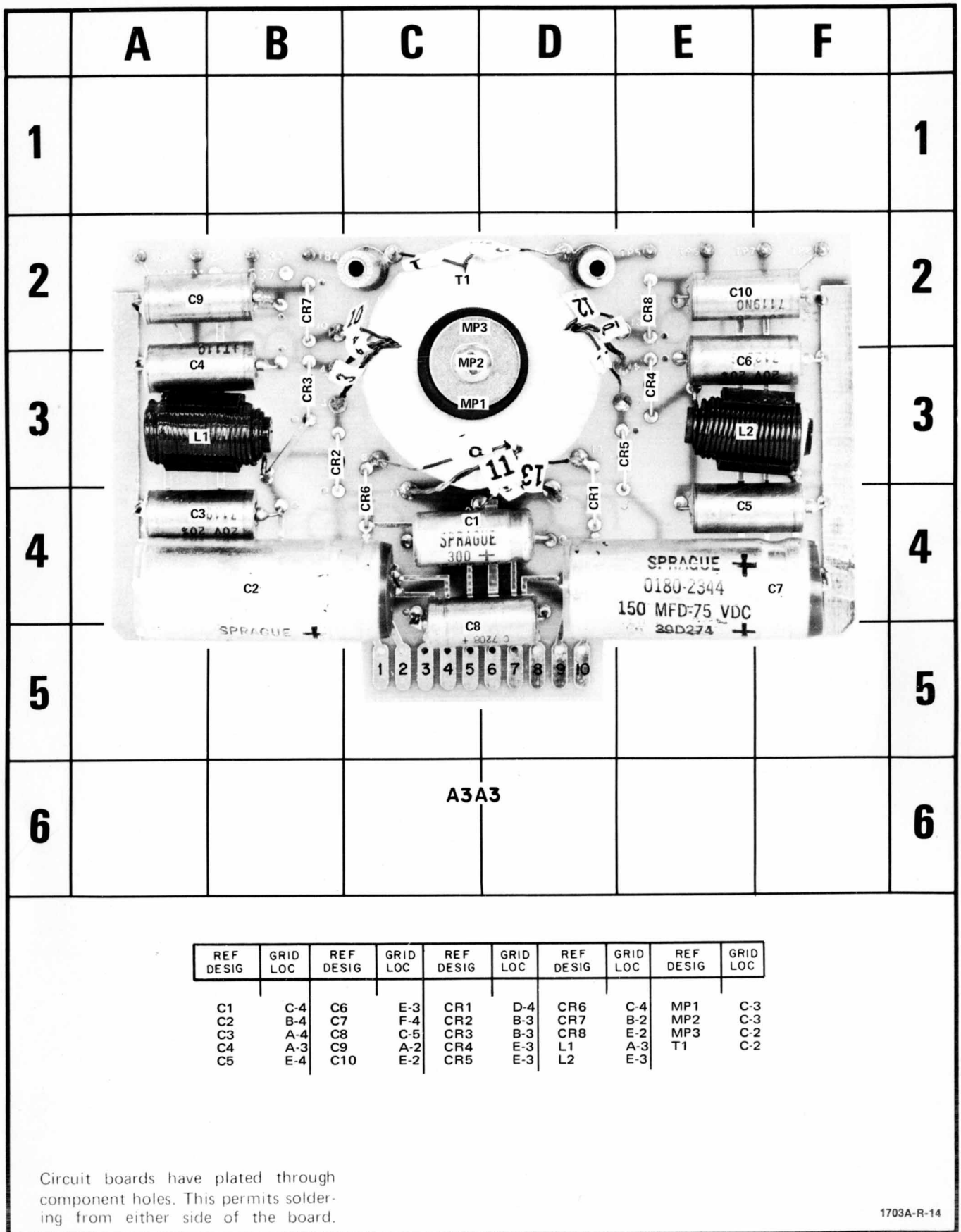
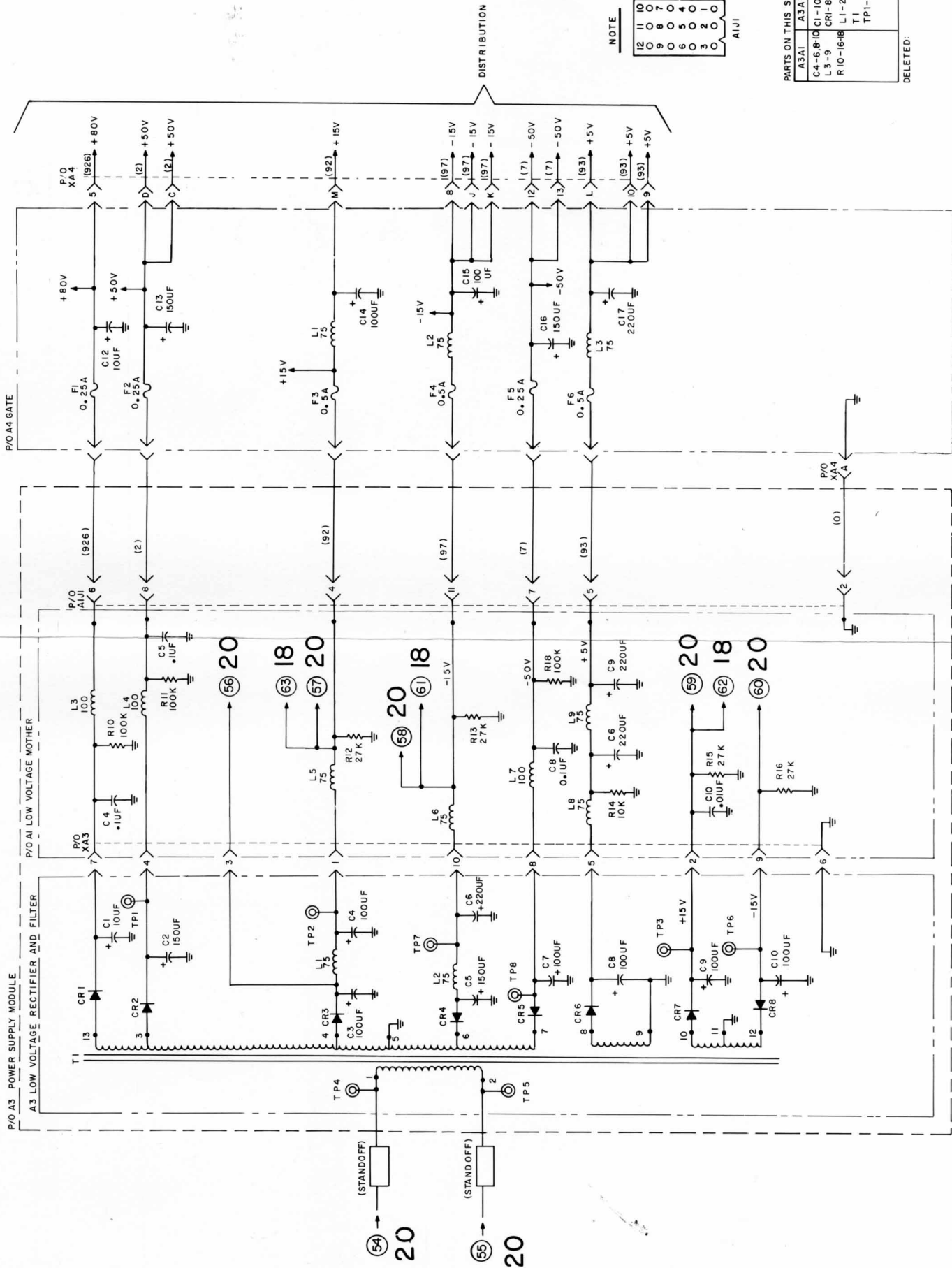
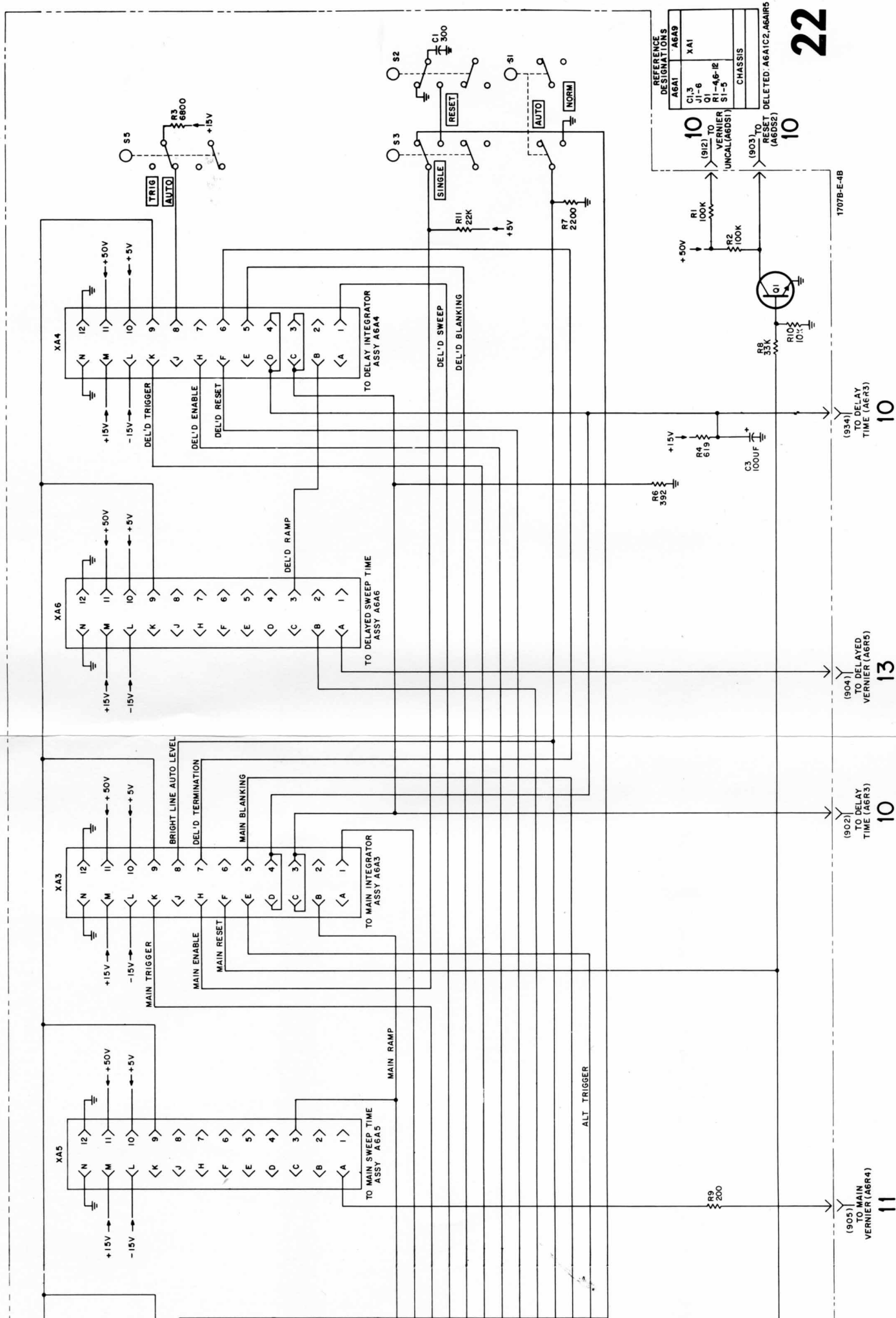


Figure 8-47. Line Rectifier and Filter A3A3 Component Identification



PARTS ON THIS SCHEMATIC			
A3A1	A3A3	A4	
C4-6,8-10	C1-10	C12-17	
L3-9	CR1-8	F1-6	
R10-16-18	L1-2	L1-3	
	T1	CHASSIS	
	TP1-8	XA4	



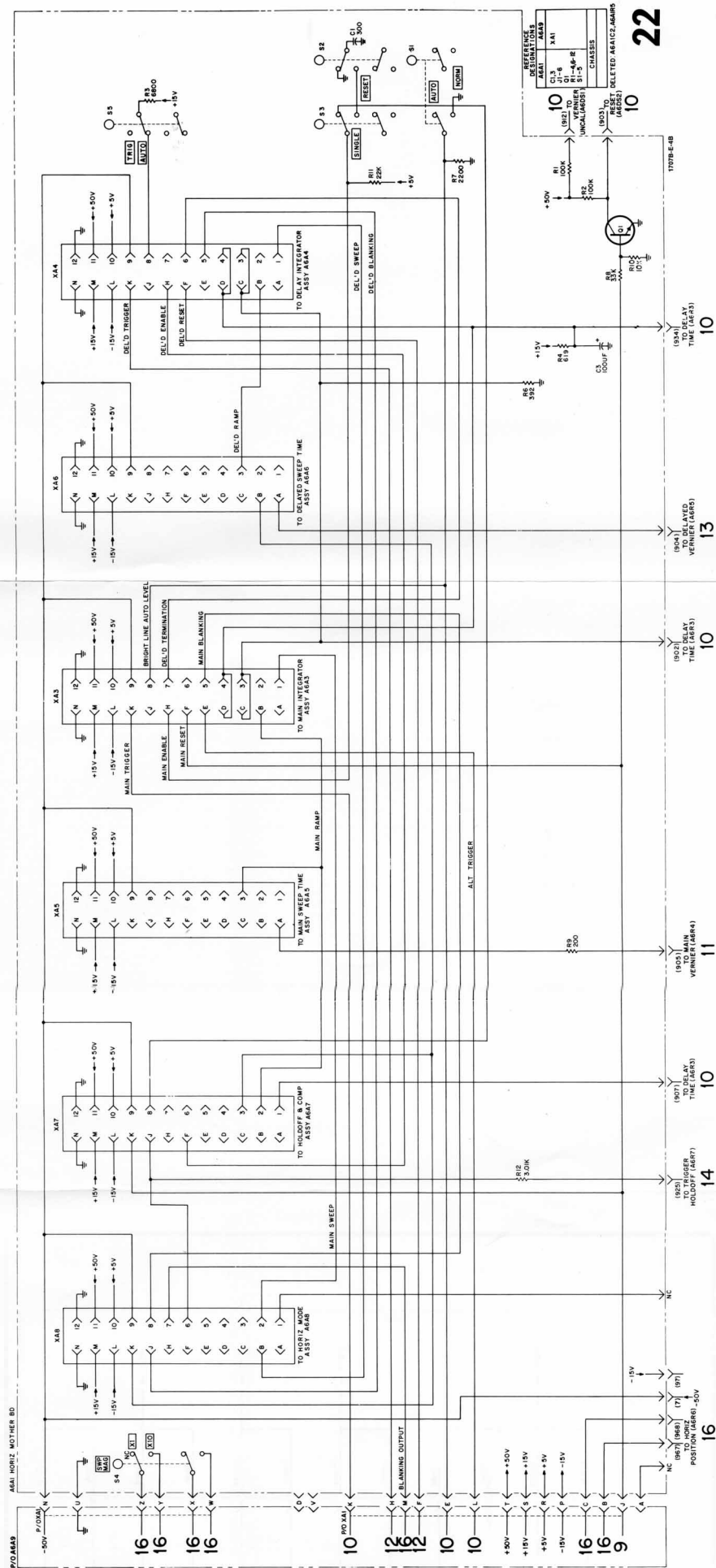
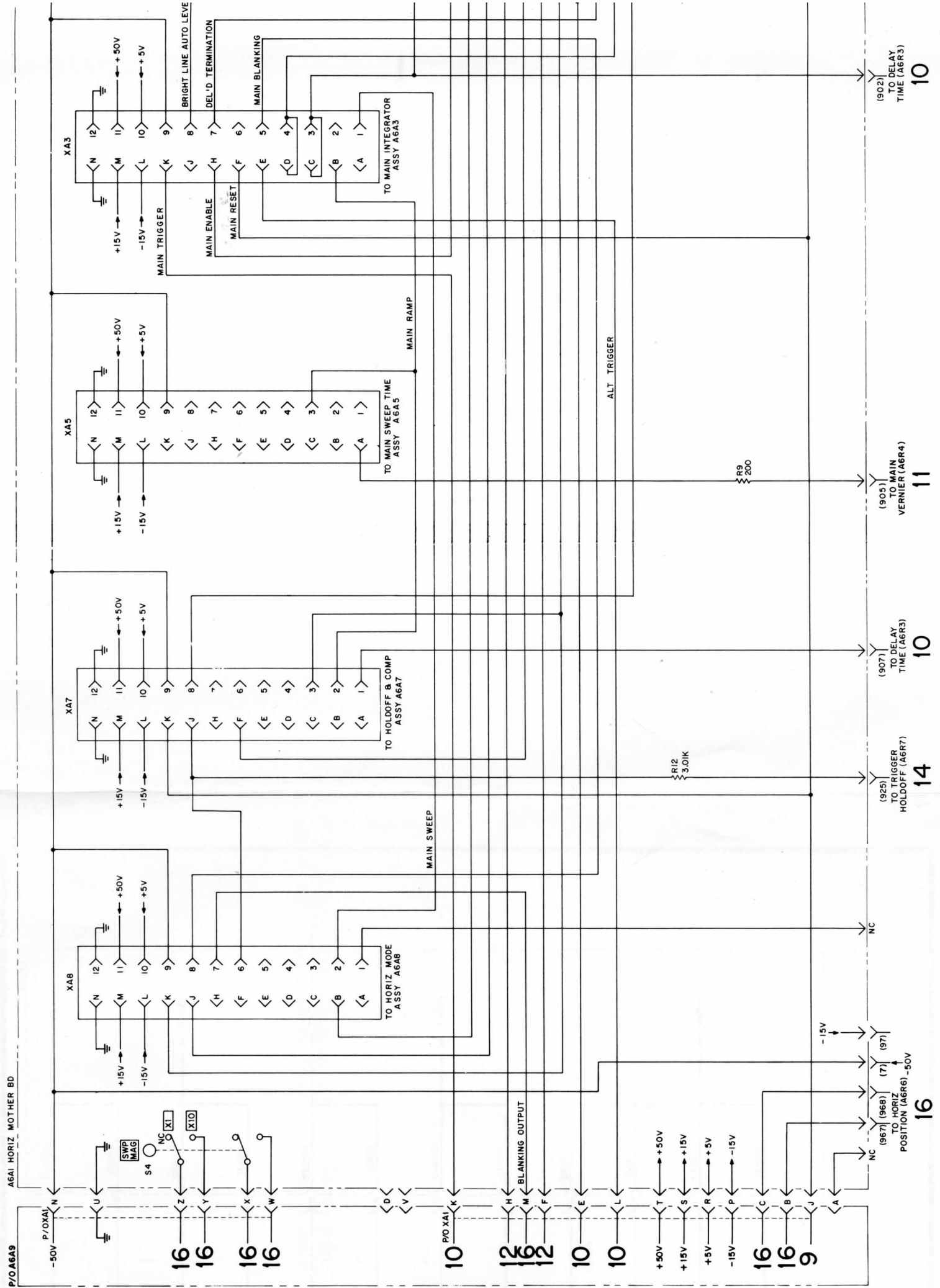
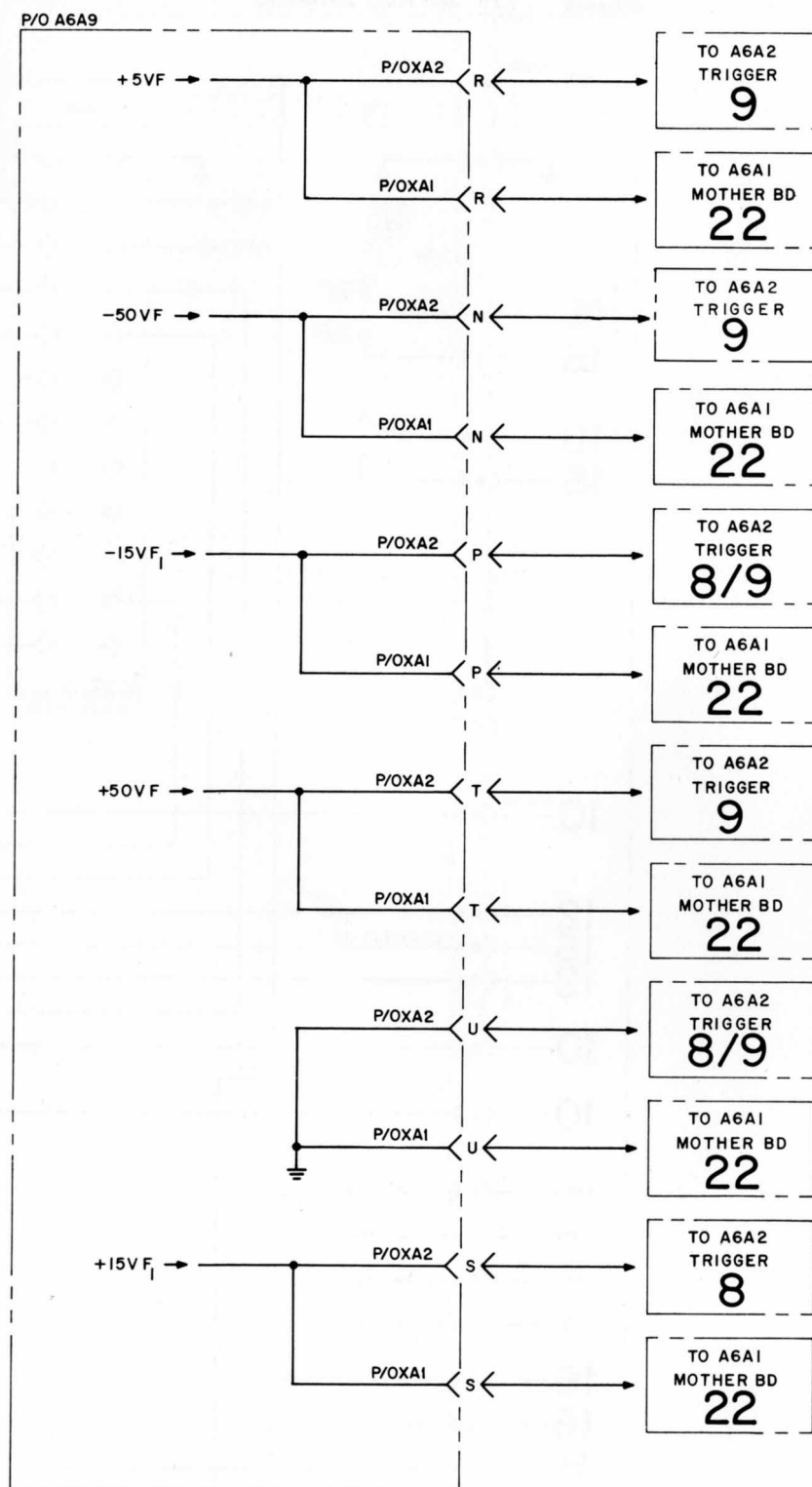


Figure 8-49.
Horizontal Mother Board A6A1
8-67





1707B-D-18

23



CATHODE-RAY TUBE WARRANTY

The cathode-ray tube (CRT) supplied in your Hewlett-Packard Oscilloscope and replacement CRT's purchased from hp are warranted by the Hewlett-Packard Company against electrical failure for a period of one year from the date of sale. Broken tubes and tubes with phosphor or mesh burns are not included under this warranty. If the CRT is broken when received, a claim should be made with the responsible carrier. All warranty claims with Hewlett-Packard should be processed through your nearest Hewlett-Packard Sales/Service Office (listed at rear of instrument manual).

We would like to evaluate every defective CRT. This engineering evaluation helps us to provide a better product for you. Please fill out the CRT Failure Report on the reverse side of this sheet and return it with the defective CRT to:

Hewlett-Packard Company
1900 Garden of the Gods Road
Colorado Springs, Colorado 80907

Attention: CRT QA

To avoid damage to the tube while in shipment, please follow the shipping instructions below; warranty credit is not allowed on broken tubes.

SHIPPING INSTRUCTIONS

It is preferable that the defective CRT be returned in the replacement CRT carton. If the carton or packaging material is not available, pack the CRT according to the instructions below:

1. Carefully wrap the tube in 1/4 inch thick cotton batting or other soft padding material.
2. Wrap the above in heavy kraft paper.
3. Pack wrapped tube in a rigid container which is at least 4 inches larger than the tube in each dimension.
4. Surround the tube with at least 4 inches of packed excelsior or similiar shock absorbing material; be sure the packing is tight all around the tube.

Thank you,

CRT Department

5950-7124

CATHODE-RAY TUBE FAILURE REPORT

DATE _____

FROM:

NAME _____

COMPANY _____

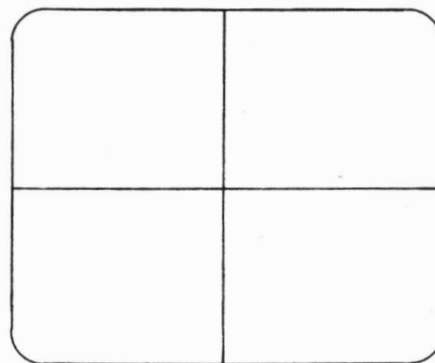
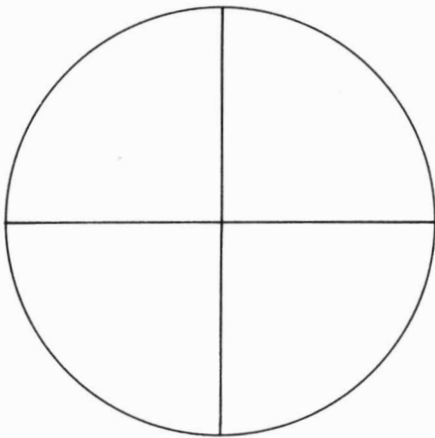
ADDRESS _____

1. HP instrument MODEL NO. _____

2. HP instrument SERIAL NO. _____

3. CRT SERIAL NO. _____

4. Please describe the failure and, if possible, show the trouble on the appropriate CRT face below.



5. Warranty claimed? Yes _____ No _____

6. HP Sales/Service Office _____ Repair Order No. _____

ELECTRONIC

SALES & SERVICE OFFICES

UNITED STATES

ALABAMA

8290 Whitesburg Dr., S.E.
P.O. Box 4207
Huntsville 35802
Tel: (205) 881-4591
TWX: 810-726-2204

ARIZONA

2336 E. Magnolia St.
Phoenix 85034
Tel: (602) 244-1361
TWX: 910-951-1330

5737 East Broadway
Tucson 85711
Tel: (602) 298-2313
TWX: 910-952-1162

(Effective Dec. 15, 1973)
2424 East Aragon Rd.
Tucson 85706
Tel: (602) 889-4661

CALIFORNIA

1430 East Orangethorpe Ave.
Fullerton 92631
Tel: (714) 870-1062
TWX: 910-592-1288

3939 Lankershim Boulevard
North Hollywood 91604
Tel: (213) 877-1282
TWX: 910-499-2170

6305 Arizona Place
Los Angeles 90045
Tel: (213) 649-2511
TWX: 910-328-6148

1101 Embarcadero Road
Palo Alto 94303
Tel: (415) 327-6500
TWX: 910-373-1280

2220 Watt Ave.
Sacramento 95825
Tel: (916) 482-1463
TWX: 910-367-2092

9606 Aero Drive
P.O. Box 23333
San Diego 92123
Tel: (714) 279-3200
TWX: 910-335-2000

COLORADO

7965 East Prentice
Englewood 80110
Tel: (303) 771-3455
TWX: 910-935-0705

CONNECTICUT

12 Lunar Drive
New Haven 06525
Tel: (203) 389-6551
TWX: 910-465-2029

FLORIDA

P.O. Box 24210
2805 W. Oakland Park Blvd.
Ft. Lauderdale 33307
Tel: (305) 731-2020
TWX: 510-955-4099

P.O. Box 13910
6177 Lake Ellenor Dr.
Orlando 32809
Tel: (305) 859-2900
TWX: 810-850-0113

GEORGIA

P.O. Box 28234
450 Interstate North
Atlanta 30328
Tel: (404) 436-6181
TWX: 910-766-4890

HAWAII

2875 So. King Street
Honolulu 96814
Tel: (808) 955-4455

ILLINOIS

5500 Howard Street
Skokie 60076
Tel: (312) 677-0400
TWX: 910-223-3613

INDIANA

3839 Meadows Drive
Indianapolis 46205
Tel: (317) 546-4891
TWX: 910-441-3263

LOUISIANA

P. O. Box 840
3239 Williams Boulevard
Kenner 70062
Tel: (504) 721-6201
TWX: 810-955-5524

MARYLAND

6707 Whitestone Road
Baltimore 21207
Tel: (301) 944-5400
TWX: 710-862-9157

MASSACHUSETTS

20010 Century Blvd.
Germantown 20767
Tel: (31) 428-0700

P.O. Box 1648
2 Choke Cherry Road
Rockville 20850
Tel: (301) 948-6370
TWX: 710-828-9684

MINNESOTA

32 Hartwell Ave.
Lexington 02173
Tel: (617) 861-8960
TWX: 710-326-6904

MICHIGAN

23855 Research Drive
Farmington 48024
Tel: (313) 476-6400
TWX: 810-242-2900

MISSOURI

2459 University Avenue
St. Paul 55114
Tel: (612) 645-9461
TWX: 910-563-3734

MISSOURI

11131 Colorado Ave.
Kansas City 64137
Tel: (816) 763-8000
TWX: 910-771-2087

148 Weldon Parkway
Maryland Heights 63043
Tel: (314) 567-1455
TWX: 910-764-0830

NEVADA

Las Vegas
Tel: (702) 382-5777

NEW JERSEY

1060 N. Kings Highway
Cherry Hill 08034
Tel: (609) 667-4000
TWX: 710-892-4945

W. 120 Century Rd.
Paramus 07652
Tel: (201) 265-5000
TWX: 710-990-4951

NEW MEXICO

P.O. Box 8366
Station C
6501 Lomas Boulevard N.E.
Albuquerque 87108
Tel: (505) 265-3713
TWX: 910-989-1665

NEW YORK

156 Wyatt Drive
Las Cruces 88001
Tel: (505) 526-2485
TWX: 910-983-0550

NEW YORK

6 Automation Lane
Computer Park
Albany 12205
Tel: (518) 458-1550
TWX: 710-441-8270

1219 Campville Road
Endicott 13760
Tel: (607) 754-0050
TWX: 510-252-0890

New York City

Manhattan, Bronx
Contact Paramus, NJ Office
Tel: (201) 265-5000
Brooklyn, Queens, Richmond
Contact Woodbury, NY Office
Tel: (516) 921-0300

82 Washington Street
Poughkeepsie 12601
Tel: (914) 454-7330
TWX: 510-248-0012

39 Saginaw Drive
Rochester 14623
Tel: (716) 473-9500
TWX: 510-253-5981

5858 East Molloy Road
Syracuse 13211
Tel: (315) 454-2486
TWX: 710-541-0482

1 Crossways Park West
Woodbury 11797
Tel: (516) 921-0300
TWX: 510-221-2168

NORTH CAROLINA

P.O. Box 6186
1923 North Main Street
High Point 27262
Tel: (919) 885-8101
TWX: 510-526-1516

OHIO

25575 Center Ridge Road
Cleveland 44145
Tel: (216) 835-0300
TWX: 810-427-9129

330 Progress Rd.
Dayton 45449
Tel: (513) 859-8202
TWX: 810-459-1925

6665 Busch Blvd.
Columbus 43229
Tel: (614) 846-1300

OKLAHOMA

P.O. Box 32008
Oklahoma City 73132
Tel: (405) 721-0200
TWX: 910-830-6862

OREGON

17890 SW Boones Ferry Road
Tualatin 97062
Tel: (503) 620-3350
TWX: 910-467-8714

PENNSYLVANIA

2500 Moss Side Boulevard
Monroeville 15146
Tel: (412) 271-0724
TWX: 710-797-3650

1021 8th Avenue
King of Prussia Industrial Park
King of Prussia 19406
Tel: (215) 265-7000
TWX: 510-660-2670

RHODE ISLAND

873 Waterman Ave.
East Providence 02914
Tel: (401) 434-5535
TWX: 710-381-7573

TENNESSEE

Memphis
Tel: (901) 274-7472

TEXAS

P.O. Box 1270
201 E. Arapaho Rd.
Richardson 75080
Tel: (214) 231-6101
TWX: 910-867-4723

P.O. Box 27409
6300 Westpark Drive
Suite 100
Houston 77027
Tel: (713) 781-6000
TWX: 910-881-2645

231 Billy Mitchell Road
San Antonio 78226
Tel: (512) 434-4171
TWX: 910-871-1170

UTAH

2890 South Main Street
Salt Lake City 84115
Tel: (801) 487-0715
TWX: 910-925-5681

VIRGINIA

P.O. Box 6514
2111 Spencer Road
Richmond 23230
Tel: (804) 285-3431
TWX: 710-956-0157

WASHINGTON

Bellevue Office Pk.
1203 - 114th SE
Bellevue 98004
Tel: (206) 454-3971
TWX: 910-443-2303

WEST VIRGINIA

Charleston
Tel: (304) 345-1640

WISCONSIN

17850 W. Belmont Road
Suite 117
Milwaukee 53227
Tel: (414) 541-0550

FOR U.S. AREAS NOT LISTED:

Contact the regional office nearest you: Atlanta, Georgia... North Hollywood, California... Paramus, New Jersey... Skokie, Illinois. Their complete addresses are listed above.
*Service Only

CANADA

ALBERTA

Hewlett-Packard (Canada) Ltd.
11748 Kingsway Ave.
Edmonton T5G 0X5
Tel: (403) 452-3670
TWX: 610-831-2431

Hewlett-Packard (Canada) Ltd.
825 - 8th Ave., S.W.
Suite 804
Calgary
Tel: (403) 262-4279

BRITISH COLUMBIA

Hewlett-Packard (Canada) Ltd.
837 E. Cordova St.
Vancouver 6
Tel: (604) 254-0531

MANITOBA

Hewlett-Packard (Canada) Ltd.
513 Century St.
Winnipeg
Tel: (204) 786-7581
TWX: 610-671-3531

NOVA SCOTIA

Hewlett-Packard (Canada) Ltd.
2745 Dutch Village Rd.
Suite 210
Halifax
Tel: (902) 455-0511
TWX: 610-271-4482

ONTARIO

Hewlett-Packard (Canada) Ltd.
1785 Woodward Dr.
Ottawa K2C 0P9
Tel: (613) 255-6180, 255-6530
TWX: 610-562-8968

Hewlett-Packard (Canada) Ltd.
50 Galaxy Blvd.
Rexdale
Tel: (416) 677-9611
TWX: 610-492-4246

QUEBEC

Hewlett-Packard (Canada) Ltd.
275 Ymuss Boulevard
Pointe Claire H9R 1G7
Tel: (514) 697-4232
TWX: 610-422-3022
Telex: 01-20807

Hewlett-Packard (Canada) Ltd.
2376 Calvan Street
Stefey GIN 4G4
Tel: (418) 688-8710

FOR CANADIAN AREAS NOT LISTED:
Contact Hewlett-Packard (Canada) Ltd. in Pointe Claire.

CENTRAL AND SOUTH AMERICA

ARGENTINA

Hewlett-Packard Argentina
S.A.C.e.I
Lavalle 1171 - 3°
Buenos Aires
Tel: 35-0436, 35-0627, 35-0341
Telex: 012-1009
Cable: HEWPACK ARG

BOLIVIA

Stambuk & Mark (Bolivia) LTDA.
Av. Mariscal, Santa Cruz 1342
La Paz
Tel: 40626, 53163, 52421
Telex: 3560014
Cable: BUKMAR

BRAZIL

Hewlett-Packard Do Brasil
I.E.C. Ltda.
Rua Frei Caneca 1119
01307-Sao Paulo-SP
Tel: 288-7111, 287-5858
Telex: 309151/2/3
Cable: HEWPACK Sao Paulo

Hewlett-Packard Do Brasil
I.E.C. Ltda.
Praça Dom Feliciano, 78
90000-Porto Alegre-RS
Rio Grande do Sul (RS) Brasil
Tel: 25-8470
Cable: HEWPACK Porto Alegre

CHILE

Hector Calcagni y Cia, Ltda.
Casilla 16.475
Santiago
Tel: 423 96
Cable: CALCAGNI Santiago

COLOMBIA

Instrumentacion
Henrik A. Langebaek & Kier S.A.
Carrera 7 No. 48-59
Aparato Aéreo 6287
Bogota, D.E.
Tel: 45-78-06, 45-55-46
Cable: AARIS Bogota
Tel: 44400INSTCO

COSTA RICA

Lic. Alfredo Gallegos Gordian
Aparato 10159
San Jose
Tel: 21-86-13
Cable: CALGUR San Jose

ECUADOR

Laboratorios de Radio-Ingenieria
Calle Guayaquil 1246
Post Office Box 3199
Quito
Tel: 212-496; 219-185
Cable: HORVATH Quito

EL SALVADOR

Electronic Associates
Aparato Postal 1682
Centro Comercial Gigante
San Salvador, El Salvador C.A.
Paseo Escalon 4649-4° Piso
Tel: 23-44-60, 23-32-37
Cable: ELEGAS

GUATEMALA

IPESA
Avenida La Reforma 3-48,
Zona 9
Guatemala
Tel: 63627, 64736
Cable: 4192 TELTRO GU

MEXICO

Hewlett-Packard Mexicana,
S.A. de C.V.
Torres Adalid No. 21, 11 Piso
Col. del Valle
Mexico 12, D.F.
Tel: 543-42-32
Telex: 017-74-507

NICARAGUA

Roberto Terán G.
Aparato Postal 689
Edificio Terán
Managua
Tel: 3451, 3452
Cable: ROTERAN Managua

PANAMA

Electrónico Balboa, S.A.
P.O. Box 4929
Ave. Manuel Espinosa No. 13-50
Bldg. Alina
Panama City
Tel: 230833
Telex: 3481103, Curunda,
Canal Zone
Cable: ELECTRON Panama City

PARAGUAY

Z. J. Melamed S.R.L.
Division: Aparatos y Equipos
Medicos
Division: Aparatos y Equipos
Scientificos y de
Investigacion
P.O. Box 676
Chile, 482, Edificio Victoria
Asuncion
Tel: 4-5069, 4-6272
Cable: RAMEL

PERU

Compania Electro Médica S.A.
1785 Woodward Dr.
San Isidro
Casilla 1030
Lima
Tel: 22-3900
Cable: ELMED Lima

PUERTO RICO

San Juan Electronics, Inc.
P.O. Box 5187
Ponce de Leon 154
Pda. 3-PTA de Tierra
San Juan 00906
Tel: (809) 725-3342, 722-3342
Cable: SATRONICS San Juan
Tel: SATRON 3450 332

URUGUAY

Pablo Ferrando S.A.
Comercial e Industrial
Avenida Italia 2877
Casilla de Correo 370
Montevideo
Tel: 40-3102
Cable: RADIUM Montevideo

VENEZUELA

Hewlett-Packard de Venezuela
C.A.
Aparato 50933
Edificio Segre
Tercera Transversal
Los Ruices Norte
Caracas 107
Tel: 35-06-11
Telex: 21146 HEWPACK
Cable: HEWPACK Caracas

FOR AREAS NOT LISTED,

CONTACT:
Hewlett-Packard
Inter-Americas
3200 Hillview Ave.
Palo Alto, California 94304
Tel: (415) 493-1501
TWX: 910-373-1267
Cable: HEWPACK Palo Alto
Telex: 034-8300, 034-8493

EUROPE

AUSTRIA
Hewlett-Packard Ges.m.b.H.
Handelska 52/3
P.O. Box 7
A-1205 Vienna
Tel: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a

BELGIUM
Hewlett-Packard Benelux
S.A. N.V.
Avenue de Col-Vert, 1.
(Groenkraaglaan)
B-1170 Brussels
Tel: (02) 72 22 40
Cable: PALOBEN Brussels
Telex: 23 494 paloben bru

DENMARK
Hewlett-Packard A/S
Datavej 38
DK-3460 Birkerød
Tel: (01) 81 66 40
Cable: HEWPAK AS
Telex: 166 40 hp as
Hewlett-Packard A/S
Torvet 9
DK-8600 Silkeborg
Tel: (06) 82-71-66
Telex: 166 40 hp as
Cable: HEWPAK AS

FINLAND
Hewlett-Packard Oy
Bulevardi 26
P.O. Box 12185
SF-00120 Helsinki 12
Tel: (90) 13730
Cable: HEWPAK OY Helsinki
Telex: 12-15633 hel

FRANCE
Hewlett-Packard France
Quartier de Courtaubert
Boite Postale No. 6
F-91401 Orsay
Tel: (1) 607 78 25
Cable: HEWPAK Orsay
Telex: 60048
Hewlett-Packard France
Agence Regionale
4 Quai des Etoiles
F-69321 Lyon Cedex 1
Tel: (78) 42 63 45
Cable: HEWPAK Lyon
Telex: 31617

Hewlett-Packard France
Zone Aeronautique
Avenue Clement Ader
F-31770 Colomiers
Tel: (61) 86 81 55
Telex: 51957

Hewlett-Packard France
Agence Regionale
Boulevard Ferat-Gamara
Boite Postale No. 11
F-13100 Luyens
Tel: (47) 24 00 66
Telex: 41770

Hewlett-Packard France
Agence Regionale
63, Avenue de Rochester
F-35000 Rennes
Tel: (99) 36 33 21
Telex: 70912 F

Hewlett-Packard France
Agence Regionale
74, Allée de la Robertsau
F-67000 Strasbourg
Tel: (88) 35 23 20 21
Telex: 89141
Cable: HEWPAK STRBG

GERMAN FEDERAL REPUBLIC
Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Bernerstrasse 117
Postfach 560 140
D-6000 Frankfurt 56
Tel: (0611) 50 041
Cable: HEWPAKSA Frankfurt
Telex: 41 32 49 fra

Hewlett-Packard GmbH
Vertriebsbüro Bublilingen
Herrenbergerstrasse 110
D-7030 Bublilingen, Württemberg
Tel: (07031) 66 72 87
Cable: HEPAK Bublilingen
Telex: 72 65 739 bbn

Hewlett-Packard GmbH
Vertriebsbüro Düsseldorf
Vogelsanger Weg 38
D-4000 Düsseldorf
Tel: (0211) 63 80 31/38
Telex: 85/86 533 hppd d

Hewlett-Packard GmbH
Vertriebsbüro Hamburg
Wendstr. 21
D-2000 Hamburg 1
Tel: (040) 24 13 93
Cable: HEWPAKSA Hamburg
Telex: 21 63 032 hpbh d

Hewlett-Packard GmbH
Vertriebsbüro Hannover
Mellendorfer Strasse 3
D-3000 Hannover-Kleefeld
Tel: (0511) 55 06 26
Telex: 41770

Hewlett-Packard GmbH
Vertriebsbüro Nürnberg
Hersbrückerstrasse 42
D-8500 Nürnberg
Tel: (0911) 57 10 66
Telex: 623 860

Hewlett-Packard GmbH
Vertriebsbüro München
Unterhachinger Strasse 28
ISAR Center
D-8012 Ottobrunn
Tel: (089) 60 30 61/7
Telex: 52 49 85
Cable: HEWPAKSA München

(West Berlin)
Hewlett-Packard GmbH
Vertriebsbüro Berlin
Wilmerdorfer Strasse 113/114
D-1000 Berlin W. 12
Tel: (030) 3137046
Telex: 18 34 05 hpbh d

GREECE
Kostas Karayannis
18, Ermou Street
GR-Athens 126
Tel: 3230-303, 3230-305
Cable: RAKAR Athens
Telex: 21 59 62 rkar gr

IRELAND
Hewlett-Packard Ltd.
224 Bath Road
GB-Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
Telex: 848413

Hewlett-Packard Ltd.
The Graftons
Stamford New Road
Altrincham, Cheshire
Tel: (061) 928-9021
Telex: 668068

ITALY
Hewlett-Packard Italiana S.p.A.
Via Amerigo Vesputci 2
I-20124 Milan
Tel: (2) 6251 10 lines
Cable: HEWPAKIT Milan
Telex: 32046

Hewlett-Packard Italiana S.p.A.
Piazza Marconi, 25
I-00144 Rome - Eur
Tel: (6) 5912544 5, 5915947
Cable: HEWPAKIT Rome
Telex: 61514

Hewlett-Packard Italiana S.p.A.
Vicolo Pastori, 3
I-35100 Padova
Tel: (49) 66 40 62
Telex: 32046 via Milan

Hewlett-Packard Italiana S.p.A.
Via Colli, 24
I-10129 Turin
Tel: (11) 53 82 64
Telex: 32046 via Milan

LUXEMBURG
Hewlett-Packard Benelux
S.A. N.V.
Avenue de Col-Vert, 1.
(Groenkraaglaan)
B-1170 Brussels
Tel: (03) 021 72 22 40
Cable: PALOBEN Brussels
Telex: 23 494

NETHERLANDS
Hewlett-Packard Benelux N.V.
Weerdestein 117
P.O. Box 7825
NL-Amsterdam, 1011
Tel: 020-42 77 77, 44 29 66
Cable: PALOBEN Amsterdam
Telex: 13 216 hpa nl

NORWAY
Hewlett-Packard Norge A/S
Nesveien 13
Box 149
N-1344 Haslum
Tel: (02) 53 83 60
Telex: 16621 hpnas n

PORTUGAL
Electra-Empresa Tecnica de
Equipamentos Electricos S.A.R.L.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-Lisbon 1
Tel: (19) 68 60 72
Cable: TELETRA Lisbon
Telex: 1598

SPAIN
Hewlett-Packard Española, S.A.
Ieriz, No 9
E-Madrid 16
Tel: 458 26 10
Telex: 23515 hpe

Hewlett-Packard Española, S.A.
Milesado 21-23
E-Barcelona 17
Tel: (3) 203 62 00
Telex: 52603 hpe e

SWEDEN
Hewlett-Packard Sverige AB
Enghetsvägen 1-3
Fack
S-161 20 Bromma 20
Tel: (08) 98 12 50
Cable: MEASUREMENTS
Telex: 10721

Hewlett-Packard Sverige AB
Hägersgatan 9C
S-431 41 Mölndal
Tel: (031) 27 68 00 01
Telex: Via Bromma

SWITZERLAND
Hewlett-Packard (Schweiz) AG
Zürcherstrasse 20
P.O. Box 64
CH-8952 Schlieren Zurich
Tel: (01) 98 18 21/24
Cable: HPAG CH
Telex: 53933 hpag ch

Hewlett-Packard (Schweiz) AG
9, Chemin Louis-Pictet
CH-1214 Vernier - Geneva
Tel: (022) 41 4950
Cable: HEWPAKSA Geneva
Telex: 27 333 hpsa ch

TURKEY
Telekom Engineering Bureau
Saglik Sok No. 15/1
Ayaspa-Beyoglu
P.O. Box 337 Beyoglu
TR-Istanbul
Tel: 49 40 40
Cable: TELEMATI Istanbul
Telex: 688068

UNITED KINGDOM
Hewlett-Packard Ltd.
224 Bath Road
GB-Slough, SL1 4 DS, Bucks
Tel: Slough (0753) 33341
Cable: HEWPIE Slough
Telex: 848413

Hewlett-Packard Ltd.
"The Graftons"
Stamford New Road
GB-Altrincham, Cheshire
Tel: (061) 928-9021
Telex: 668068

Hewlett-Packard Ltd's registered
address for V.A.T. purposes
only:
70, Finsbury Pavement
London, EC2A1SX
Registered No: 690597

**SOCIALIST COUNTRIES
PLEASE CONTACT:**
Hewlett-Packard Ges.m.b.H.
Handelska 52/3
P.O. Box 7
A-1205 Vienna
Ph: (0222) 33 66 06 to 09
Cable: HEWPAK Vienna
Telex: 75923 hewpak a

**ALL OTHER EUROPEAN
COUNTRIES CONTACT:**
Hewlett-Packard S.A.
Rue du Bois-du-Lan 7
P.O. Box 85
CH-1217 Meyrin 2 Geneva
Switzerland
Tel: (022) 41 54 00
Cable: HEWPAKSA Geneva
Telex: 2 24 86

AFRICA, ASIA, AUSTRALIA

ANGOLA
Teletra-Empresa Tecnica
de Equipamentos Electricos
SARL
Rua de Barbosa, Rodrigues,
42-1, 01
P.O. Box 6487
Luanda
Cable: TELETRA Luanda

AUSTRALIA
Hewlett-Packard Australia
Pty. Ltd.
22-26 Weir Street
Glen Iris, 3146
Victoria
Tel: 20-1371 (6 lines)
Cable: HEWPAK Melbourne
Telex: 31 024

Hewlett-Packard Australia
Pty. Ltd.
31 Bridge Street
Pymble,
New South Wales, 2073
Tel: 449 6566
Telex: 21561
Cable: HEWPAK Sydney

Hewlett-Packard Australia
Pty. Ltd.
97 Churchill Road
Prospect 5082
South Australia
Tel: 44 8151
Cable: HEWPAK Adelaide

Hewlett-Packard Australia
Pty. Ltd.
14 40 Civil Lines
Kampur 208 001
Tel: 6 88 82
Cable: BLUESTAR

Hewlett-Packard Australia
Pty. Ltd.
10 Woolley Street
P.O. Box 191
Dickson A.C.T. 2602
Tel: 49 8194
Cable: HEWPAK Canberra ACT

Hewlett-Packard Australia
Pty. Ltd.
2nd Floor, 49 Gregory Terrace
Brisbane, Queensland, 4000
Tel: 29 1544

CEYLON
United Electricals Ltd.
P.O. Box 681
60, Park St.
Colombo 2
Tel: 26596
Cable: HOTPOINT Colombo

CYPRUS
Kyprionics
19 Gregorios & Xenopoulos Road
P.O. Box 1152
CY-Nicosia
Tel: 45628/29
Cable: KYPRONICS PANDEHIS

ETHIOPIA
African Salespower & Agency
Private Ltd., Co.
P.O. Box 718
58 59 Cunningham St.
Addis Ababa
Tel: 12285
Cable: ASACO Addisababa

HONG KONG
Schmidt & Co. (Hong Kong) Ltd.
P.O. Box 297
Connalight Centre
39th Floor
Connaught Road, Central
Hong Kong
Tel: 240168, 232735
Cable: HX4766
Cable: SCHMIDTCO Hong Kong

INDIA
Blue Star Ltd.
Kasturi Buildings
Jamshedji Tata Rd.
Bombay 400 020
Tel: 29 50 21
Cable: BLUEFROST

Blue Star Ltd.
Sahas
414/2 Vir Savarkar Marg
Prabhadevi
Bombay 400 025
Tel: 45 78 87
Telex: 4093
Cable: FROSTBLUE

Blue Star Ltd.
Band Box House
Prabhadevi
Bombay 400 025
Tel: 45 73 01
Telex: 3751
Cable: BLUESTAR

Blue Star Ltd.
7 Hare Street
P.O. Box 506
Calcutta 700 001
Tel: 23-0131
Cable: BLUESTAR

Blue Star Ltd.
34 Ring Road
Lajpat Nagar
New Delhi 110 024
Tel: 62 32 76
Telex: 2463
Cable: BLUESTAR

Blue Star Ltd.
Blue Star House
Lajpat Nagar
New Delhi 110 024
Tel: 62 32 76
Telex: 2463
Cable: BLUESTAR

Blue Star Ltd.
Blue Star House
Bangalore 560 025
Tel: 5568
Telex: 430
Cable: BLUESTAR

Blue Star Ltd.
Blue Star House
Bangalore 560 025
Tel: 5568
Telex: 430
Cable: BLUESTAR

Blue Star Ltd.
Blue Star House
Bangalore 560 025
Tel: 5568
Telex: 430
Cable: BLUESTAR

Blue Star Ltd.
1-1-117-1
Sarajini Devi Road
Secunderabad 500 003
Tel: 7 63 91, 7 73 93
Cable: BLUEFROST
Telex: 459

Blue Star Ltd.
23 24 Second Line Beach
Madras 600 001
Tel: 23954
Cable: BLUESTAR

Blue Star Ltd.
Nathraj Mansions
2nd Floor Bistupur
Jamshedpur 831 001
Tel: 38 04
Cable: BLUESTAR
Telex: 240

INDONESIA
Bah Bolon Trading Coy. N.V.
Dialah Merdeka 29
Bandung
Tel: 4915, 51560
Cable: ILMU
Telex: 08-809

IRAN
Multi Corp International Ltd.
Avenue Soraya 130
P.O. Box 1212
IR Teheran
Tel: 83 10 35-39
Cable: MULTICORP Tehran
Telex: 2853 MCI TN

ISRAEL
Electronics & Engineering
Div. of Motorola Israel Ltd.
17 Aminadav Street
Tel-Aviv
Tel: 36941 (3 lines)
Cable: BASTEL Tel-Aviv
Telex: 33569

JAPAN
Yokogawa-Hewlett-Packard Ltd.
Onashi Building
1-59-1 Yoyogi
Shibuya-ku, Tokyo
Tel: 03-70281/92
Telex: 232-2024YHP
Cable: YHPMARKET TOK 23-721

Yokogawa-Hewlett-Packard Ltd.
Nishi Ibaragi Bldg.
2-2 Kasuga
Ibaragi-Shi
Osaka
Tel: 0726-23-1641
Telex: 5332-385 YHP OSAKA

Yokogawa-Hewlett-Packard Ltd.
Nakamo Building
No. 24 Kamisazasima-cho
Nakamura-ku, Nagoya City
Tel: (052) 571-5171

Yokogawa-Hewlett-Packard Ltd.
Nitto Bldg.
2-2 Shinohara-Kita
Kohoku-ku
Yokohama 222
Tel: 045-432-1504
Telex: 382-3204 YHP YOK

Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg.
Rm. 603 3,
2-Chome
JZUMI-CHO,
Mitoh, 310
Tel: 0292-25-7470

KENYA
Kenya Kinetics
P.O. Box 18311
Nairobi, Kenya
Tel: 57726
Cable: PROTON

KOREA
American Trading Company
Korea
I.P.O. Box 1103
Dae Kyung Bldg., 8th Floor
107 Sejong-Ro,
Chongro-Ku, Seoul
Tel: (4 lines) 73-8924-7
Cable: AMTRACO Seoul

LEBANON
Constantin E. Macridis
P.O. Box 7213
RL-Beirut
Tel: 220846
Cable: ELECTRONUCLEAR Beirut

MALAYSIA
MECOMB Malaysia Ltd.
2 Lorong 13/6A
Section 13
Petaling Jaya, Selangor
Cable: MECOMB Kuala Lumpur
Telex: 2853 MCI TN

MOZAMBIQUE
A.N. Goncalves, Lda.
162, Av. D. Luis
P.O. Box 107
Lourenco Marques
Tel: 27091, 27114
Telex: 6-203 Negon Mo
Cable: NEGON

NEW ZEALAND
Hewlett-Packard (N.Z.) Ltd.
94-96 Dixon Street
P.O. Box 9443
Courtenay Place,
Wellington
Tel: 59-559
Telex: 3898
Cable: HEWPAK Wellington

Hewlett-Packard (N.Z.) Ltd.
Pakuranga Professional Centre
267 Pakuranga Highway
Box 51092
Pakuranga
Tel: 569-651
Cable: HEWPAK, Auckland

NIGERIA
The Electronics Instrumenta-
tions Ltd. (TEIL)
144 Agege Motor Rd., Mushin
P.O. Box 6645
Lagos
Cable: THETEIL Lagos

The Electronics Instrumenta-
tions Ltd. (TEIL)
16th Floor Cocoa House
P.M.B. 5402
Ibadan
Tel: 22325
Cable: THETEIL Ibadan

PAKISTAN
Musko & Company, Ltd.
Osman Chambers
Abdullah Haroon Road
Karachi 3
Tel: 511027, 512927
Cable: COOPERATOR Karachi

Musko & Company, Ltd.
388, Satellite Town
Rawalpindi
Tel: 41924
Cable: FEMUS Rawalpindi

PHILIPPINES
Electromex, Inc.
6th Floor, Amalgamated
Development Corp. Bldg.
Ayala Avenue, Makati, Rizal
C.C.P.O. Box 1028
Makati, Rizal
Tel: 86-18-87, 87-76-77,
87-86-88, 87-18-45, 88-91-71,
88-11-12, 88-82-12
Cable: ELEMEX Manila

SINGAPORE
Mechanical & Combustion
Engineering Company Pte.,
Ltd.
10, 12, Jalan Kilang
Red Hill Industrial Estate
Singapore, 3
Tel: 647151 (7 lines)
Cable: MECOMB Singapore

Hewlett-Packard Far East
Area Office
P.O. Box 87
Alexandra Post Office
Singapore 3
Tel: 633022
Cable: HEWPAK SINGAPORE

SOUTH AFRICA
Hewlett-Packard South Africa
(Pty.), Ltd.
Hewlett-Packard House
Daphne Street, Wendywood,
Sandton, Transvaal 2001
Tel: 407641 (five lines)

Hewlett-Packard South Africa
(Pty.), Ltd.
Breecrease House
Bree Street
Cape Town
Tel: 2-6941/2/3
Cable: HEWPAK Cape Town
Telex: 0006 CT

Hewlett-Packard South Africa
(Pty.), Ltd.
641 Ridge Road, Durban
P.O. Box 95
Durban, Natal
Tel: 88-6102
Telex: 567954
Cable: HEWPAK

TAIWAN
Hewlett-Packard Taiwan
39 Chung Shiao West Road
Sec. 1
Overseas Insurance
Corp. Bldg. 7th Floor
Taipei
Tel: 389160, 1-2, 375121,
Ext. 240-249
Telex: TP824 HEWPAK
Cable: HEWPAK Taipei

THAILAND
UNIMESA Co., Ltd.
Chongkoinsee Building
56 Suriwongse Road
Bangkok
Tel: 37956, 31300, 31307,
37540
Cable: UNIMESA Bangkok

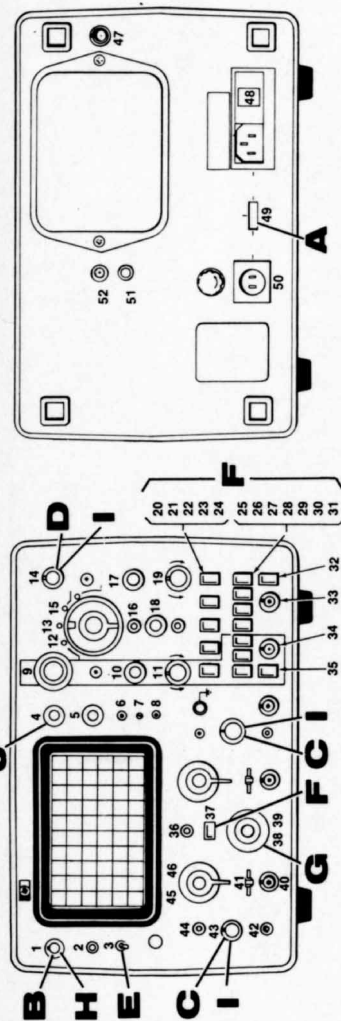
UGANDA
Uganda Tele-Electric Co., Ltd.
P.O. Box 4449
Kampala
Tel: 57279
Cable: COMCO Kampala

VIETNAM
Peninsula Trading Inc.
P.O. Box H-3
216 Hien-Vuong
Saigon
Tel: 20-805, 93398
Cable: PENTRA, SAIGON 242

ZAMBIA
R. J. Tibury (Zambia) Ltd.
P.O. Box 2792
Lusaka
Zambia, Central Africa
Tel: 73793
Cable: ARJAYTEE, Lusaka

**MEDITERRANEAN AND
MIDDLE EAST COUNTRIES
NOT SHOWN PLEASE
CONTACT:**
Hewlett-Packard
Co-ordination Office for
Mediterranean and Middle
East Operations
Piazza Marconi 25
I-00144 Rome-Eur, Italy
Tel: (6) 58 40 29
Cable: HEWPAKIT Rome
Telex: 61514

**OTHER AREAS NOT
LISTED, CONTACT:**
Hewlett-Packard
Export Trade Company
1200 Hillview Ave.
Palo Alto, California 94301
Tel: (415) 326-7000
(Fax: 71 493-1501)
TWX: 910-373-1267
Cable: HEWPAK Palo Alto
Telex: 034-8300, 034-8493



TURN-ON PROCEDURE

- SET REAR POWER MODE SWITCH TO DESIRED POWER SOURCE.
- SET INTENSITY MAX. CW.
- SET HORIZONTAL POSITION TO MIDRANGE.
- SET HORIZONTAL POSITION TO MIDRANGE.
- SET POWER SWITCH ON AND ALLOW 15 MINUTE WARM UP.
- SET ALL PUSHBUTTONS TO OUT POSITION.
- SET DISPLAY SWITCH TO A AND TRIGGER SELECTOR TO A ONLY TRIG.
- ADJUST INTENSITY FOR VISIBLE TRACE.
- ADJUST VERTICAL AND HORIZONTAL POSITION TO CENTER TRACE.
- ADJUST FOCUS FOR SHARP TRACE.

CRT AND GENERAL

- INTENSITY. CONTROLS BRIGHTNESS OF DISPLAY.
- BEAM FINDER. RETURNS DISPLAY TO VIEWING AREA.
- POWER-ON. SWITCH FOR TURNING OSCILLOSCOPE ON AND OFF. LIGHT ILLUMINATES WHEN POWER IS ON. LIGHT FLASHES WHEN BATTERY IS DISCHARGED.
- FOCUS. ADJUSTS BEAM FOR SHARP TRACE.
- SCALE ILLUM. CONTROLS BRIGHTNESS OF SCALE ILLUMINATION.
- TRACE ALIGN. ALIGNS TRACE WITH HORIZONTAL GRATICULE LINE.
- CAL 1 VOLT. 1-KHZ SQUARE WAVE AT 1 VOLT $\pm 1\%$.
- ASTIGMATISM. ADJUSTS ROUNDEDNESS OF SPOT.
- HORIZONTAL DELAY TIME. SELECTS DELAY BETWEEN START OF MAIN SWEEP AND START OF DELAYED SWEEP.
- DELAYED VERNIER. PROVIDES CONTINUOUS CONTROL OF SWEEP TIME BETWEEN CALIBRATED POSITIONS OF DELAYED TIME/DIV SWITCH.
- DELAYED TRIGGER LEVEL. SELECTS AMPLITUDE POINT ON TRIGGER SIGNAL THAT STARTS DELAYED SWEEP.
- DELAYED TIME/DIV. CONTROLS SWEEP TIME IN DELAYED MODE. CONTROLS INTENSIFIED PORTION OF SWEEP IN MAIN MODE.

CONTROLS AND CONNECTORS

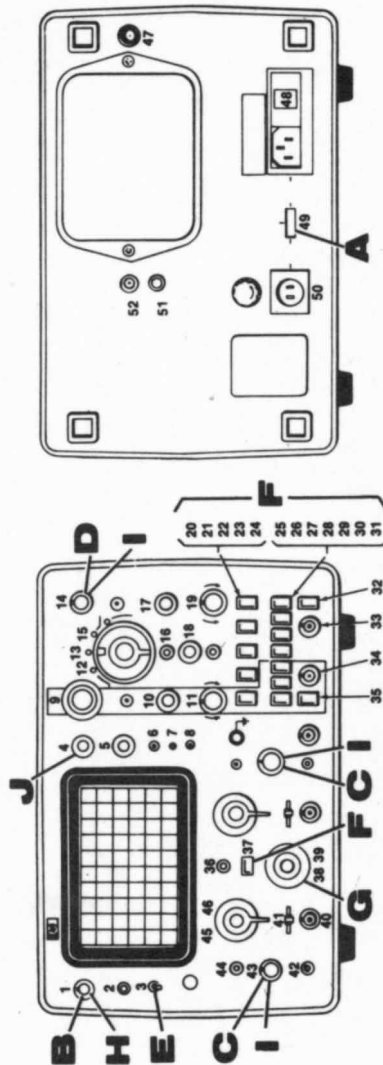
- SWEEP DISPLAY. SELECTS MAIN, DELAYED, MIXED SWEEP, OR EXT HORIZ INPUT.
- HORIZONTAL POSITION. CONTROLS HORIZONTAL POSITION OF DISPLAY.
- MAIN TIME/DIV. CONTROLS SWEEP TIME IN MAIN SWEEP MODE.
- VERNIER UNCAL. LIGHT WHEN EITHER MAIN OR DELAYED VERNIER IS NOT IN CAL POSITION.
- MAIN VERNIER. PROVIDES CONTINUOUS CONTROL OF SWEEP BETWEEN CALIBRATED POSITIONS OF MAIN TIME/DIV SWITCH.
- TRIGGER HOLD OFF. PROVIDES CONTINUOUS CONTROL OF TIME BETWEEN SWEEPS. NORM-HOLD OFF TIME IS MINIMUM.
- MAIN TRIGGER LEVEL. SELECTS AMPLITUDE POINT ON TRIGGER SIGNAL THAT STARTS MAIN SWEEP.
- AUTO/TRIG. AUTO. DELAYED SWEEP STARTS AUTOMATICALLY AT END OF DELAY TIME. DELAYED SWEEP ARMS AT END OF DELAY TIME. SINGLE. SELECTS SINGLE OR NORMAL SWEEP OPERATION.
- RESET. RESETS SWEEP IN SINGLE SWEEP MODE; RESET LIGHT INDICATES WHEN SWEEP IS ARMED.
- AUTO/NORM. AUTO. AUTOMATIC SWEEP IN ABSENCE OF TRIGGER SIGNAL OR TRIGGERED SWEEP BY SIGNAL ABOVE 40 HZ RATE. NORM. MAIN SWEEP IS TRIGGERED ONLY BY APPLYING A TRIGGER SIGNAL.
- SWP MAG. IN X10 POSITION, SWEEP IS MAGNIFIED TEN TIMES.
- DELAYED HF REJ. ATTENUATES DELAYED SWEEP TRIGGER SIGNALS ABOVE 30 KHZ.
- DELAYED AC/DC. SELECTS DELAYED SWEEP TRIGGER SIGNAL COUPLING.
- DELAYED INT/EXT. SELECTS INTERNAL OR EXTERNAL SWEEP TRIGGERING FOR DELAYED SWEEPS.
- MAIN INT/EXT. SELECTS INTERNAL OR EXTERNAL SWEEP TRIGGERING FOR MAIN SWEEP.
- AC/DC. SELECTS MAIN SWEEP TRIGGER SIGNAL COUPLING.
- HF REJ. ATTENUATES MAIN SWEEP TRIGGER SIGNALS ABOVE 30 KHZ.
- LF REJ. ATTENUATES MAIN SWEEP TRIGGER SIGNALS BELOW 15 KHZ.
- MAIN SLOPE. SELECTS SLOPE OF MAIN TRIGGER SIGNAL.
- EXT TRIG INPUTS. MAIN SWEEP EXTERNAL TRIGGER INPUT.
- EXT TRIG INPUTS. DELAYED SWEEP EXTERNAL TRIGGER INPUT.
- DELAYED SLOPE. SELECTS SLOPE OF DELAYED SWEEP TRIGGER SIGNAL.
- VERTICAL VERNIER UNCAL. LIGHTS WHEN EITHER VERNIER CONTROL IS OUT OF CAL POSITION.
- B POLARITY. CONTROLS CHANNEL B POLARITY.
- DISPLAY. SELECTS DISPLAY MODE OF CHANNEL A, B, A+B, CHOP OR ALT.
- TRIG. A ONLY TRIG. INTERNAL TRIGGER SIGNAL IS CHANNEL A. NORM TRIG. INSTRUMENT TRIGGERS ON DISPLAYED SIGNAL EXCEPT IN ALT MODE. ALT MODE IS TRIGGERED ON COMPOSITE SYNC (LF REJ MUST BE USED TO MAINTAIN PROPER TRIGGERING).
- INPUT. INPUT SIGNAL CONNECTS TO BNC CONNECTOR.
- COUPLING (AC-GND-DC). SELECTS CAPACITIVE (AC) OR DIRECT (DC) COUPLING OF INPUT SIGNAL, OR GROUND (GND) THE AMPLIFIER STAGE.
- DC BAL. ADJUST TO MINIMIZE VERTICAL SHIFT OF TRACE WHEN VERNIER IS ROTATED.
- POSITION. CONTROLS VERTICAL POSITION OF DISPLAY.
- CAL. ADJUST TO CALIBRATE AMPLIFIER WITH SETTING OF VOLTS/DIV SWITCH.
- VERNIER (CAL). PROVIDES CONTINUOUS ADJUSTMENTS OF VOLTS/DIV BETWEEN CALIBRATED POSITIONS OF VOLTS/DIV SWITCH.
- VOLTS/DIV. SELECTS THE VERTICAL DEFLECTION FACTOR NECESSARY FOR CALIBRATED MEASUREMENTS.
- Z AXIS INPUT. Z AXIS INPUT CONNECTOR.
- AC LINE. POWER INPUT FROM AC LINE.
- POWER MODE. SELECTS DC LINE, AC LINE OR INTERNAL BATTERY OPERATION.
- DC LINE. POWER INPUT FOR DC LINE OPERATION.
- EXT HORIZ VERNIER. PERMITS 10:1 HORIZONTAL AMPLIFIER GAIN.
- EXT HORIZ INPUT. INPUT TO EXTERNAL HORIZONTAL AMPLIFIER.

REAR PANEL

for
MODEL 1707B
OSCILLOSCOPES
MARCH 1974

EINSCHALTEN DES GERÄTS

- A. UMSCHALTER AUF DIE ENTSPRECHENDE NETZSPANNUNG EINSTELLEN. (RÜCKWAND).
- B. INTENSITÄT NACH LINKS DREHEN.
- C. VERT. POSITION FÜR KANAL A UND B AUF MITTELSTELLUNG DREHEN.
- D. HORIZONTALE POSITION AUF MITTELSTELLUNG DREHEN.
- E. GERÄT EINSCHALTEN, 15 MINUTEN WARTEN.
- F. DRUCKTASTEN NICHT EINDRÜCKEN.
- G. SCHALTER FÜR KANALWAHL AUF KANAL A, TRIGGERSCHALTER AUF "A ONLY TRIG" STELLEN.
- H. INTENSITÄT AUF GEWÜNSCHTE HELLIGKEIT STELLEN.
- I. MIT EINSTELLER FÜR VERTIKALE UND HORIZONTALE POSITION GRUNDLINIE AUF BILDSCHIRMMITTE EINSTELLEN.
- J. STRAHL FOKUSSIEREN.



BEDIENUNGSELEMENTE UND ANSCHLÜSSE

KATHODENSTRAHLRÖHRE, ALLGEMEINES

1. INTENSITY, HELLIGKEITSEINSTELLUNG.
2. BEAM FINDER, BRINGT DARSTELLUNG AUF DEN BILDSCHIRM, UNABHÄNGIG VON DER POSITIONSEINSTELLUNG.
3. POWER ON, NETZSCHALTER: LAMPE LEUCHTET, WENN GERÄT EINGESCHALTET IST, LAMPE BLINKT, WENN BATTERIELADUNG ZU GERING.
4. FOCUS, EINSTELLUNG DER STRAHLSCHÄRFE.
5. SCALE ILLUM, EINSTELLUNG DER RASTERBELEUCHTUNG.
6. TRACE ALIGN, EINSTELLUNG DER GRUNDLINIE PARALLEL ZUM HORIZONTAL RASTER.
7. CAL 1 VOLT, KALIBRIERSIGNAL, 1 KHZ-RECHTECK, $1V \pm 1\%$.
8. ASTIGMATISM, EINSTELLUNG FÜR RUNDHEIT DES STRAHLPUNKTES.

HORIZONTAL-VERSTÄRKER

9. DELAY TIME, VERZÖGERUNGSEINSTELLUNG DER ZWEITEN ZEITBASIS GEGENÜBER DER HAUPTZEITBASIS.
10. DELAYED VERNIER, FEINEINSTELLUNG FÜR ABLENKGESCHWINDIGKEIT DER VERZ. ZEITBASIS.
11. DELAYED TRIGGER LEVEL, EINSTELLUNG DES TRIGGER-NIVEAUS DER VERZ. ZEITBASIS.
12. DELAYED TIME/DIV, EINSTELLUNG DER ABLENKZEIT DER VERZ. ZEITBASIS, EINSTELLUNG FÜR AUFGEHELLTEN TEIL BEI DARSTELLUNG NUR MIT HAUPTZEITBASIS.

13. SWEEP DISPLAY, UMSCHALTUNG AUF HAUPTZEITBASIS, VERZ. ZEITBASIS ODER GEMISCHTE ZEITBASIS.
14. HORIZONTAL POSITION, LINKS-RECHTSVERSchiebung DER GRUNDLINIE.
15. MAIN TIME/DIV, EINSTELLUNG DER ABLENKZEIT (HAUPTZEITBASIS).
16. VERNIER UNCAL, LEUCHTET, WENN FEINEINSTELLUNG FÜR ERSTE UND ZWEITE ZEITBASIS NICHT IN STELLUNG CAL.
17. MAIN VERNIER, STUFENLOSE EINSTELLUNG ZWISCHEN DEN BEREICHEN DER ABLENKZEITEN.
18. TRIGGER HOLD-OFF, EINSTELLUNG DER TRIGGER-PAUSE.
19. MAIN TRIGGER LEVEL, EINSTELLUNG DES TRIGGER-NIVEAUS FÜR HAUPTZEITBASIS.
20. AUTO/TRIG
AUTO, ZWEITE ZEITBASIS SETZT AUTOMATISCH EIN.
TRIG, ZWEITE ZEITBASIS WIRD NACH VERZÖGERTE ZEIT AUF TRIGGER-SIGNAL AUSGELOST.

21. SINGLE, UMSCHALTER FÜR EINMALIGE ZEITABLENKUNG.
22. RESET, RÜCKSETZUNG DER ZEITBASIS ZUR VORBEREITUNG EINER EINMALIGEN ABLENKUNG, LAMPE LEUCHTET DANN AUF.
23. AUTO/NORM
AUTO, EINE AUTOMATIK LÄSST AUCH OHNE ANGELEGTES TRIGGER-SIGNAL DIE ZEITBASIS ARBEITEN, ERST BEI TRIGGER-SIGNAL OBERHALB 40 HZ WIRD AUTOMATIK ABGESCHALTET.
NORM, TRIGGER-SIGNAL IS ERFORDERLICH.

24. SWP MAG, IN STELLUNG X 10 ERFOLGT 10-FACHE DEHNUNG DER ABLENKZEIT.
25. DELAYED HF REL, TRIGGERSIGNALE ÜBER 30 KHZ WERDEN ABGESCHWÄCHT. (ZWEITE ZEITBASIS).
26. DELAYED AC/DC, EINGANGSKOPPLUNG DES TRIGGERSIGNALS FÜR ZWEITE ZEITBASIS (AC = KAPAZITIV, DC = DIREKTE KOPPLUNG).
27. DELAYED INT/EXT, UMSCHALTER INTERNE ODER EXTERNE TRIGGERUNG DER ZWEITEN ZEITBASIS.
28. MAIN INT/EXT, INTERNE ODER EXTERNE TRIGGERUNG FÜR HAUPTZEITBASIS.
29. AC/DC, TRIGGER-SIGNAL-KOPPLUNG FÜR HAUPTZEITBASIS.
30. HF REL, TRIGGERSIGNALE ÜBER 30 KHZ WERDEN ABGESCHWÄCHT (HAUPTZEITBASIS).
31. LF REL, TRIGGERSIGNALE UNTER 15 KHZ WERDEN ABGESCHWÄCHT (HAUPTZEITBASIS).
32. MAIN SLOPE, FLANKENUMSCHALTUNG DES TRIGGER-SIGNALS (HAUPTZEITBASIS).
33. EXT TRIG INPUTS, EINGANG FÜR EXTERNE TRIGGERSIGNALS (HAUPTZEITBASIS).
34. EXT TRIG INPUTS, EINGANG FÜR EXTERNE TRIGGERSIGNALS (VERZ. ZEITBASIS).
35. DELAYED SLOPE, FLANKENUMSCHALTUNG DES TRIGGER-SIGNALS (VERZ. ZEITBASIS).
36. VERNIER UNCAL, LAMPE LEUCHTET, WENN FEINEINSTELLUNG FÜR KANAL A ODER B NICHT IN STELLUNG CAL IST.

VERTIKAL-VERSTÄRKER

37. B POLARITY, POLARITÄTUMSCHALTUNG FÜR KANAL B.
38. DISPLAY, SCHALTER ZUR DARSTELLUNG VON KANAL A, B; A UND B ALTERNIEREND ODER GETASTET (CHOPPED).
39. TRIG
A ONLY TRIG, INTERNE TRIGGERUNG DURCH KANAL A.
NORM TRIG, INTERNE TRIGGERUNG DURCH DAS JEWEILS ANGEZEIGTE SIGNAL. BEI ALT-BETRIEB MÜSSEN AN BEIDEN KANÄLEN EINGANGSSIGNALE LIEGEN, ZUR LEICHTEREN TRIGGERUNG IST DIE TASTE LF REL ZU DRÜCKEN.
40. INPUT BNC, SIGNAL-EINGANG.
41. COUPLING (AC-GND-DC), UMSCHALTUNG AUF KAPAZITIV (AC) ODER DIREKTE (DC) KOPPLUNG DES EINGANGS, IN STELLUNG G (GND) WIRD SIGNAL ABGETRENNT UND VERSTÄRKER-EINGANG AN MASSE GELEGT.
42. DC BAL, VERSTÄRKERBALANCE EINSTELLUNG.
43. POSITION, EINSTELLUNG DER VERTIKALEN VERSCHIEBUNG.
44. CAL, KALIBRIERUNG DES VERSTÄRKERS.
45. VERNIER (CAL), FEINEINSTELLUNG.
46. VOLTS/DIV, SCHALTER FÜR VERTIKALE EINGANGS-EMPFINDLICHKEIT.
47. Z-AXIS, INPUT, BNC, EINGANG FÜR Z-VERSTÄRKER.
48. AC LINE, STECKER FÜR NETZKABEL (WECHSELSTROM).

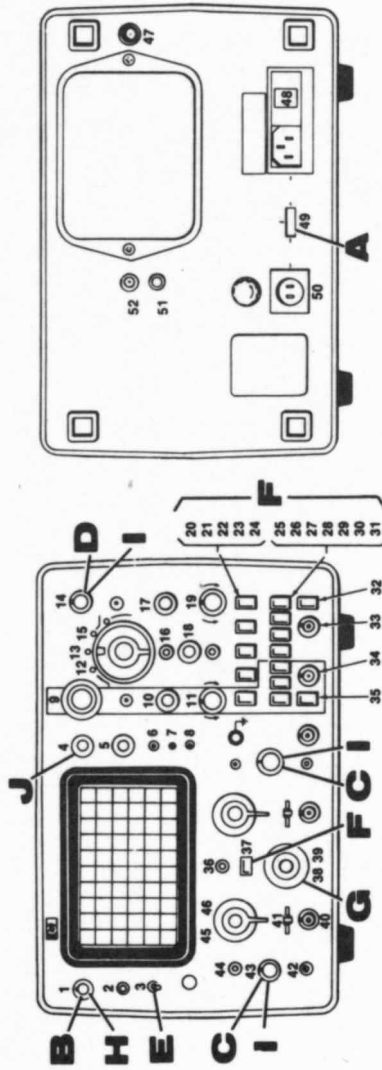
RÜCKSEITE

52. EXT HORIZ INPUT, BNC-EINGANG FÜR DAS EXTERNE WAAGRECHTABELNKUNGSSIGNAL.

OSZILLOGRAPH
MODELL 1707B

FEB. 1974

MISE EN ROUTE



- A. METTRE LE COMMUTATEUR "POWER MODE" SUR LA SOURCE D'ALIMENTATION DESIREE.
- B. METTRE "INTENSITY" A FOND EN SENS INVERSE DES AIGUILLES D'UNE MONTRE
- C. METTRE POSITION A ET B A MI-COURSE.
- D. METTRE "HORIZONTAL POSITION" A MI-COURSE.
- E. METTRE L'INTERRUPTEUR "POWER" SUR "ON".
- F. METTRE TOUTS LES BOUTONS POUSSOIRS EN POSITION "SORTIE".
- G. METTRE LE COMMUTATEUR "DISPLAY" SUR "A" ET LE SELECTEUR SYNCHRO SUR "A" OU "TRIG".
- H. AJUSTER "INTENSITY" ET "HORIZONTAL POSITION" POUR CENTRER LA TRACE.
- I. AJUSTER "FOCUS" POUR OBTENIR UNE TRACE FINE.

COMMANDES ET CONNECTEURS

24. SWP MAG: EN X10, LE BALAYAGE EST DILATE 10 FOIS.
25. DELAYED HF - REJ: ATTENUER LES SIGNAUX DE SYNCHRONISATION PAR DES FREQUENCES > 30 KHZ.
26. DELAYED AC/DC: DETERMINE LE COUPLAGE DE L'ENTREE SYNCHRONISATION.
27. DELAYED INT/EXT: DETERMINE LE MODE DE SYNCHRONISATION INTERIEURE OU EXTERIEURE POUR LE BALAYAGE RETARDE.
28. MAIN INT/EXT: DETERMINE LE MODE DE SYNCHRONISATION INTERIEURE OU EXTERIEURE POUR LA BASE DE TEMPS PRINCIPALE.
29. AC/DC: DETERMINE LE COUPLAGE DE L'ENTREE SYNCHRONISATION.
30. AF REJ: ATTENUER LES SIGNAUX DE SYNCHRONISATION POUR DES FREQUENCES > 30 KHZ.
31. LF REJ: ATTENUER LES SIGNAUX DE SYNCHRONISATION POUR DES FREQUENCES < 15 KHZ.
32. MAIN SLOPE: DETERMINE LA PENTE DU SIGNAL DE SYNCHRONISATION.
33. EXT. TRIG. INPUTS: ENTREE SYNCHRONISATION EXTERIEURE POUR BALAYAGE PRINCIPAL.
34. EXT. TRIG. INPUTS: ENTREE SYNCHRONISATION EXTERIEURE POUR BALAYAGE RETARDE.
35. DELAYED SLOPE: DETERMINE LA PARTIE DU SIGNAL DE SYNCHRONISATION.
36. VERNIER UNCAL: S'ALLUME LORSQUE L'UN DES VERNIERS EST EN DEHORS DE LA POSITION CALIBREE.

TUBE CATHODIQUE ET GENERALITES

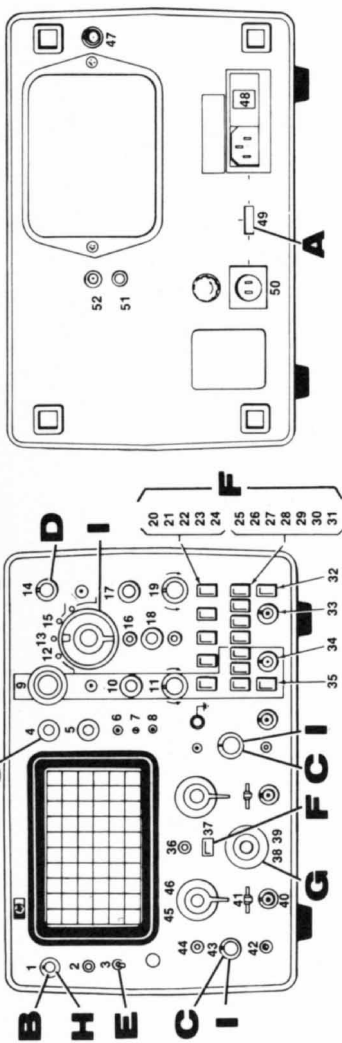
1. INTENSITY: CONTROLE LA LUMINOSITE DE LA TRACE.
2. BEAM FINDER: RAMENE LE SIGNAL DANS LA ZONE OBSERVABLE.
3. POWER ON: INTERRUPTEUR DE MISE EN ROUTE.
4. FOCUS: AJUSTE LA FINESSE DE LA TRACE.
5. SCALE ILLUM: CONTROLE L'ILLUMINATION DU GRATICULE.
6. TRACE ALIGN: ALIGNE LA TRACE AVEC LA LIGNE HORIZONTALE DU GRATICULE.
7. CAL 1 VOLT: ONDE CARREE 1 KHZ $\pm$ 1%.
8. ASTIGMATISM: AJUSTE LA FORME DU SPOT.
9. DELAY TIME: DETERMINE LE DELAI ENTRE LE DEPART DE LA BASE DE TEMPS PRINCIPALE ET RETARDEE.
10. DELAYED VERNIER: PERMET LE CONTROLE PROGRESSIF DE LA DUREE BALAYAGE ENTRE LES POSITIONS CALIBREES DU COMMUTATEUR "DELAYED TIME/DIV".
11. DELAYED TRIGGER LEVEL: DETERMINE LE SEUIL DE DECLENCHEMENT DE LA BASE DE TEMPS RETARDEE.
12. DELAYED TIME/DIV: CONTROLE LA DUREE DU BALAYAGE RETARDE ET LA ZONE SURINTENSIFIEE EN BASE DE TEMPS PRINCIPALE.

37. B POLARITY: CONTROLE LA POLARITE VOIE B.
38. DISPLAY: CHOISI LE MODE DE VISUALISATION: VOIE A, B, A + B, DECOUPE OU ALTERNE.
39. TRIG: A ONLY TRIG: SYNCHRONISATION PAR LE SIGNAL VOIE A. NORM TRIG: SYNCHRONISATION PAR LE SIGNAL OBSERVE SAUF EN MODE ALTERNE OU LA SYNCHRONISATION EST COMPOSEE. LE REJ DOIT ETRE UTILISE POUR OBTENIR UNE BONNE SYNCHRONISATION.
40. INPUT: ENTREE SIGNAL.
41. COUPLING (AC - GND - AC): DETERMINE LE COUPLAGE ENTREE: CAPACITIF AC, DIRECT (DC).
42. DC BAL: A AJUSTER AFIN DE REDUIRE LE DEPLACEMENT VERTICAL DE LA TRACE EN FONCTION DE LA POSITION VERNIER.
43. POSITION: CONTROLE LA POSITION VERTICALE DU SIGNAL.
44. CAL: A AJUSTER POUR CALIBRER L'AMPLIFICATEUR EN FONCTION DE LA POSITION DU COMMUTATEUR VOLT/DIV.
45. VERNIER (CAL): PERMET UN AJUSTEMENT PROGRESSIF DE LA SENSIBILITE/DIVISION ENTRE LES POSITIONS CALIBREES DU COMMUTATEUR VOLT/DIV.
46. VOLTS/DIV: CHOISI LE FACTEUR DE CALIBRATION VERTICAL NECESSAIRE POUR DES MESURES ETALONNEES.
47. Z AXIS INPUT: ENTREE AXE Z.

52. EXT HORIZ INPUT: ENTREE DE FLEXION X.

ENCENDIDO DEL INSTRUMENTO

- A. COLOQUESE EL SELECTOR DE ALIMENTACION (PANEL TRASERO) EN LA POSICION DE LA CORRIENTE DISPONIBLE.
- B. GIROSE POR COMPLETO A LA IZQUIERDA EL CONTROL DE INTENSIDAD (INTENSITY).
- C. COLOQUESE EN EL PUNTO MEDIO LOS CONTROLES A Y B.
- D. COLOQUESE EN EL PUNTO MEDIO EL CONTROL DE POSICION HORIZONTAL.
- E. PASESE A ENCENDIDO (ON) LA LLAVE INTERRUPTORA (POWER).
- F. COLOQUE TODOS LOS BOTONES DE PRESION EN LA POSICION HACIA AFUERA.
- G. PONGASE EN A EL SELECTOR DE PRESENTACION (DISPLAY) Y EL SELECTOR DE DISPARO EN A ONLY TRIG.
- H. AJUSTESE LA INTENSIDAD (INTENSITY) HASTA OBTENER UN TRAZO VISIBLE.
- I. AJUSTESE LA POSICION VERTICAL Y LA HORIZONTAL PARA CENTRALIZAR EL TRAZO.
- J. AJUSTESE EL FOCO (FOCUS) PARA LOGRAR UN TRAZO BIEN DEFINIDO.



CONTROLES Y CONECTORES

36. DISPLAY. SELECCIONA EL MODO DE PRESENTACION: CANAL A; B; A + B; CANALES SIMULTANEOS O ALTERNADOS.

39. TRIG.

A ONLY TRIG. LA SEÑAL DE DISPARO INTERNO NO ESTÁ CONECTADA AL CANAL A.

NORM TRIG. EL INSTRUMENTO SE ACTIVA CON LA SEÑAL PRESENTADA, EXCEPTO EN EL MODO ALTERNADO (ALT). DICHO MODO SE ACTIVA CON SINCRONIZACION COMBINADA. (DEBE USARSE EL CONTROL LF REJ PARA MANTENER EL DISPARO CORRECTO.)

40. INPUT. LA SEÑAL DE ENTRADA SE INSERTA MEDIANTE EL CONECTOR BNC.

41. COUPLING (AC-GND-DC). SELECCIONA EL ACOPAMIENTO CAPACITIVO (AC) O DIRECTO (DC) DE LA SEÑAL DE ENTRADA O CONECTA A TIERRA (GND) LA ETAPA DE AMPLIFICACION.

42. DC BAL. SE AJUSTA PARA REDUCIR AL MINIMO EL DESPLAZAMIENTO VERTICAL DEL TRAZO CUANDO SE GIRA EL VERNIER O NONIO.

43. POSITION. CONTROLA LA POSICION VERTICAL DE LA PRESENTACION.

44. CAL. SE AJUSTA PARA CALIBRAR EL AMPLIFICADOR SEGUN LA POSICION DEL SELECTOR VOLTS/DIV.

45. VERNIER (CAL). PERMITE UN AJUSTE CONTINUO DE VOLTS/DIVISION ENTRE LAS POSICIONES CALIBRADAS DEL SELECTOR VOLTS/DIV.

46. VOLTS/DIV. SELECCIONA EL FACTOR DE DEFLEXION VERTICAL NECESARIO PARA LAS MEDICIONES CALIBRADAS.

PANEL POSTERIOR

47. Z AXIS INPUT. CONECTOR DE ENTRADA DEL EJE Z.

48. AC LINE. ENTRADA DE ALIMENTACION DE C.A.

PANTALLA Y EN GENERAL

1. INTENSITY. REGULA LA BRILLANTEZ DEL TRAZO.

2. BEAM FINDER. DEVUELVE EL HAZ A LA ZONA VISIBLE.

3. POWER ON. ENCIENDE O APAGA EL OSCILOSCOPIO. LA LAMPARA SE ILLUMINA EN LA POSICION DE ENCENDIDO (ON). LA LAMPARA DESTELLA CUANDO LA BATERIA ESTÁ DESCARGADA.

4. FOCUS. AJUSTA EL HAZ PARA OBTENER UN TRAZO FINO.

5. SCALE ILLUM. REGULA LA LUMINOSIDAD DE LA ESCALA.

6. TRACE ALIGN. ALINEA EL TRAZO CON LA LINEA HORIZONTAL DEL RETICULO.

7. CAL 1 VOLT. ONDA CUADRADA DE 1 KHZ A 1 VOLT, $\pm 1\%$.

8. ASTIGMATISM. AJUSTA LA REDONDEZ DEL PUNTO DEL HAZ EN LA PANTALLA.

HORIZONTAL

9. DELAY TIME. SELECCIONA EL TIEMPO DE RETARDO ENTRE EL COMIENZO DEL BARRIDO PRINCIPAL Y EL COMIENZO DEL BARRIDO RETARDADO.

10. DELAYED VERNIER. PERMITE CONTROL CONTINUO DE LA VELOCIDAD DE BARRIDO ENTRE LAS POSICIONES CALIBRADAS DEL SELECTOR DELAYED TIME/DIV. (VER NO. 12.)

11. DELAYED TRIGGER LEVEL. SELECCIONA EL PUNTO DE AMPLITUD DE LA SEÑAL DE DISPARO QUE INICIA EL BARRIDO RETARDADO.

12. DELAYED TIME/DIV. CONTROLA LA VELOCIDAD DE BARRIDO EN EL MODO RETARDADO. REGULA LA PARTE INTENSIFICADA DEL BARRIDO EN EL MODO PRINCIPAL.

13. SWEEP DISPLAY. SELECCIONA EL MODO DE BARRIDO: PRINCIPAL, RETARDADO O MEZCLADO.

14. HORIZONTAL POSITION. CONTROLA LA POSICION HORIZONTAL DEL TRAZO.

15. MAIN TIME/DIV. CONTROLA LA VELOCIDAD DE BARRIDO EN EL MODO DE BARRIDO PRINCIPAL.

16. VERNIER UNCAL. SE ENCIENDE CUANDO EL VERNIER O NONIO DE BARRIDO PRINCIPAL O CON RETARDO ESTÁ FUERA DE LA POSICION CALIBRADA.

17. MAIN VERNIER. PERMITE CONTROL CONTINUO DEL TIEMPO DE BARRIDO ENTRE LAS POSICIONES CALIBRADAS DEL SELECTOR MAIN TIME/DIV.

18. TRIGGER HOLD OFF. PERMITE EL CONTROL CONTINUO DE TIEMPO ENTRE BARRIDOS CONSECUTIVOS. EL TIEMPO DE RETENCION NORMAL (NORM HOLD OFF) ES MINIMO.

19. MAIN TRIGGER LEVEL. SELECCIONA EL NIVEL DE AMPLITUD DE LA SEÑAL DE DISPARO QUE INICIA EL BARRIDO PRINCIPAL.

20. AUTO/TRIG. AUTO. EL BARRIDO RETARDADO SE INICIA AUTOMATICAMENTE AL TERMINAR EL PERIODO DE RETARDO.

TRIG. EL BARRIDO RETARDADO SE ARMA AL TERMINAR EL PERIODO DE RETARDO.

21. SINGLE. SELECCIONA EL MODO DE BARRIDO: SENCILLO O NORMAL.

22. RESET. REPOSICIONA EL BARRIDO EN EL MODO DE BARRIDO SENCILLO; LA LAMPARA DE RESET INDICA CUANDO EL BARRIDO ESTÁ LISTO.

23. AUTO/NORM.

AUTO. APLICA BARRIDO AUTOMATICO EN AUSENCIA DE SEÑAL DE DISPARO O BARRIDO DESCARGADO POR UNA SEÑAL SUPERIOR A 40 HZ.

NORM. EL BARRIDO PRINCIPAL SOLO SE INICIA APLICANDO UNA SEÑAL DE DISPARO.

VERTICAL

36. VERNIER UNCAL. SE ENCIENDE CUANDO CUALQUIERA DE LOS CONTROLES DE VERNIER O NONIO ESTÁ FUERA DE SU POSICION DE RETEN DE CALIBRACION.

37. B POLARITY. CONTROLA LA POLARIDAD DEL CANAL B.